FLOOD HAZARD ANALYSES

UPPER HOUSATONIC RIVER

MASSACHUSETTS

PREPARED BY THE SOIL CONSERVATION SERVICE, USDA, AMHERST, MASSACHUSETTS

MARCH 1974

Cover Photograph

Pittsfield -- West Housatonic Street (Rt. 20) between Barker and Cadwell Roads, New Year flood of 1948-1949. (Berkshire Eagle Photo)

FLOOD HAZARD ANALYSES
UPPER HOUSATONIC RIVER

within the towns of

DALTON, HINSDALE and LANESBOROUGH

and the city of

PITTSFIELD, MASSACHUSETTS

prepared by the

UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

in cooperation with the

MASSACHUSETTS WATER RESOURCES COMMISSION

BERKSHIRE CONSERVATION DISTRICT

and the communities of

DALTON, HINSDALE, LANESBOROUGH and PITTSFIELD

MARCH 1974

Throughout this report referrals to other public agencies offering additional information concerning portions of this text are made. For convenience the present addresses of those agencies are listed below:

Chairman, Conservation District Supervisors
Berkshire Conservation District
20 Elm Street
Pittsfield, Massachusetts 01201

District Conservationist
Soil Conservation Service
20 Elm Street
Pittsfield, Massachusetts 01201

Director, Division of Water Resources
Water Resources Commission
100 Cambridge Street
Boston, Massachusetts 02202

Director, Division of Conservation Services
Department of Natural Resources
100 Cambridge Street
Boston, Massachusetts 02202

Director, Berkshire County Regional Planning Commission
8 Bank Row
Pittsfield, Massachusetts 01201

Federal Insurance Administrator
U.S. Department of Housing and Urban Development
451 7th Street, S.W.
Washington, D.C. 20420

ABSTRACT

Pressures, created by increased urbanization, have intensified the demand for the use of flood plain lands in Massachusetts. Basic technical information about flood plain hazards is essential for a flood plain management program to be effectively planned and implemented.

This report provides flood hazard information for the upper portion of the Housatonic River Basin in central Berkshire County, Massachusetts. The total Upper Housatonic River study area, above the Pittsfield-Lenox boundary, encompasses a drainage area of about 92,600 acres or 144.7 square miles. The principal communities within the study area are the Towns of Dalton, Hinsdale, Lanesborough and the City of Pittsfield.

The probability of future floods of various magnitudes was evaluated, and Flood Hazard Area maps and Flood Profiles were prepared to show the extent and depth of potential flooding. To minimize the risk of flooding, consideration was given to alternative measures (regulatory and corrective) for flood plain management.

This report contains indentification of the major flood-prone areas, history of flooding, pertinent existing state and local flood plain regulations, and recommendations. State and local units of government will find this information instrumental in assessing flood problems and determining actions needed for the judicious use of lands in and adjacent to the flood plain.

ACKNOWLEDGMENTS

The cooperation and assistance given by the many agencies, organizations, industries and individuals during this Flood Hazard Analyses Study is greatly appreciated. These include:

Berkshire Conservation District

Berkshire County Regional Planning Commission

Berkshire Eagle

Corps of Engineers, U.S. Department of the Army

Crane and Co., Inc.

Geological Survey, U.S. Department of the Interior

Massachusetts Department of Natural Resources

Massachusetts Department of Public Works

Massachusetts Water Resources Commission

National Weather Service, U.S. Department of Commerce

Appreciation is also extended to the many town officials and individuals who contributed information for the study, and land owners who permitted access for field surveys, photographs and field studies.

FLOOD HAZARD ANALYSES
UPPER HOUSATONIC RIVER
MASSACHUSETTS

TABLE OF CONTENTS

TABLE OF CONTENTS (cont'd)

PLATES

TABLE OF CONTENTS (cont'd)

TABLES

TABLE OF CONTENTS (cont'd)

PHOTOGRAPHS

1/ Photograph credits: (B) Berkshire Eagle, Pittsfield, Massachusetts.
(C) Colonel Couch, Dalton, Massachusetts.
(S) Soil Conservation Service

INTRODUCTION

Data in this report are based on investigations and analyses performed by the Soil Conservation Service, U. S. Department of Agriculture, in Cooperation with the Massachusetts Water Resources Commission and the Berkshire Conservation District.

The Soil Conservation Service carries out flood hazard analyses under the authority of Section 6 of Public Law 83-566, in response to Recommendation 9(c), "Regulation of Land Use" of House Document No. 465, 89th Congress 2nd Session; and in compliance with Executive Order 11296, dated August 10, 1966. Priorities regarding location and extent of such studies in Massachusetts are established by the Massachusetts Water Resources Commission.

This report provides information which will aid state and local planners and officials in making wise land-use decisions regarding present and future use of flood plain areas.

Information on the possibility of future floods of various magnitudes and the extent of flooding which might occur in the future is included for the East, West, and Southwest Branches of the Housatonic River and for the Housatonic River north of the Pittsfield-Lenox boundary. Extent of flooding and profiles are also included for portions of the major tributaries and the significant natural floodwater storage areas.

By using the maps, tables and profiles presented in this report, the depth of flooding at most locations along the streams may be determined. With this information, intelligent flood plain management may be effected which recognizes the possibility and hazards of flooding.

The Flood Hazard Area Maps show the extent of potential flooding from the 100-year flood. The Flood Profiles show the 10-year, 100-year and rare floods. (See Glossary of Terms for detailed definititions of these potential flood events).

The maps and profiles are based on conditions that existed within the Upper Housatonic River study area at the time field surveys were made in 1971-72. Such factors as increased urbanization within the watershed; encroachment on wetland or flood plain areas; relocation or modification of bridges and other stream crossings; or stream channel improvement can have a significant effect on flood stages and areas inundated.

For example: encroachment into wetlands and flood plains tends to increase flood stages and areas inundated by usurping the natural floodwater storage. The enlargement of a restrictive stream crossing, thereby increasing flow capacity, tends to decrease flood stages and the inundated areas upstream of the crossing, but could increase flood stages and inundated areas downstream. Therefore, the results of any flood hazard analyses study should be reviewed periodically by appropriate state and local officials and planners to determine if changed watershed conditions would significantly affect the results of the study.

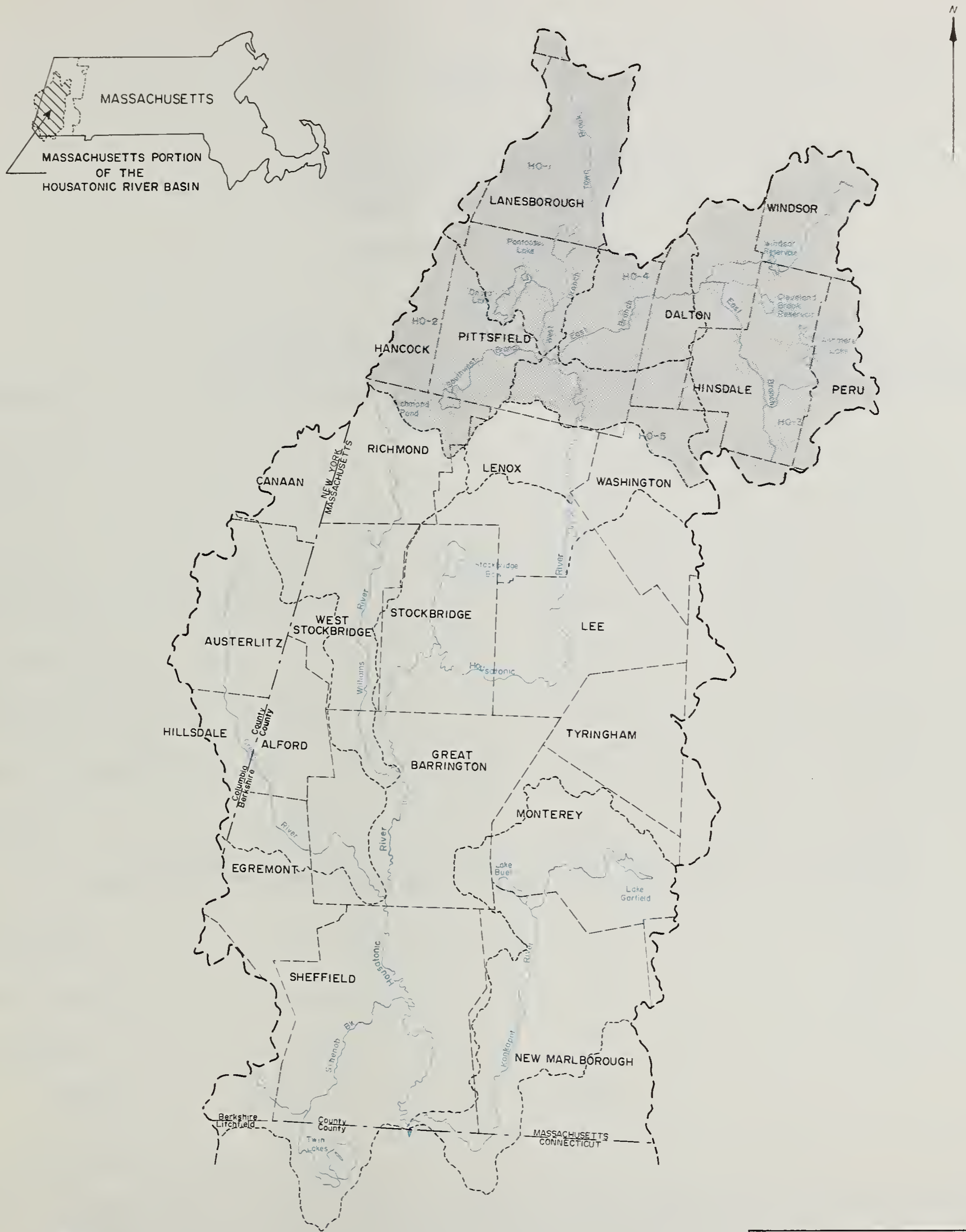
The Soil Conservation Service, U. S. Department of Agriculture, can provide limited technical assistance through the Berkshire Conservation District to federal, state, and local agencies in the interpretation and use of the information contained herein and will provide available data for flood plain management and use. Request for such assistance within the study area should be made to the Berkshire Conservation District, 20 Elm Street, Pittsfield, Massachusetts 01201.

The Massachusetts Division of Water Resources, Water Resources Commission, 100 Cambridge Street, Boston, Massachusetts 02202, will also provide information on interpretations, regulations and flood plain management solutions that pertain to this study.

DESCRIPTION OF STUDY AREA

Physical Data

Study Area -- The Upper Housatonic River is the drainage basin of the Housatonic River downstream to the Pittsfield-Lenox Boundary. The study area encompasses a drainage area of 144.7 square miles (92,600 acres) and is located entirely in central Berkshire County, abutting New York State to the West. The City of Pittsfield is almost entirely within the study area, and is the center of economic activity. Eleven towns are partially within the study area, of which eight have significant contributing drainage areas. Of these towns, Hinsdale, Lanesborough, Dalton, and the City of Pittsfield account for 71 percent of the study area. Table 1 lists the drainage areas of the communities within the study area.



LEGEND

- TOWN BOUNDARY
- STATE BOUNDARY
- WATERSHED BOUNDARY
- SUB-WATERSHED BOUNDARY
- STUDY AREA, UPPER HOUSATONIC RIVER
- HOUSATONIC RIVER AND MAJOR STREAMS
- SUB-AREA NUMBER, SEE NOTE

2 0 2 4
SCALE IN MILES

NOTE

The sub-area numbers refer to Housatonic River Basin Sub-Watersheds in the Massachusetts Water Resources Study. These HO-numbers are shown on all plates to coordinate River Basin Reports prepared by the Soil Conservation Service.

PLATE 1

FLOOD HAZARD ANALYSES
UPPER HOUSATONIC RIVER, MASSACHUSETTS

LOCATION

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

JANUARY, 1974

See Plate 2 (follows page 22) for detailed map references.

TABLE 1

DRAINAGE AREAS BY COMMUNITY

FLOOD HAZARD ANALYSES

UPPER HOUSATONIC RIVER

Community	Drainage Area within Community (Sq. Mi.)	Percent of Total Study Area	Percent of Community Area within Study Area
Cheshire[1/]	0.1	1/	0.4
Dalton	17.9	12	81.7
Hancock	9.2	6	25.6
Hinsdale	21.7	15	99.1
Lanesborough	21.3	15	72.0
Lenox[1/]	0.4	1/	1.8
New Ashford[1/]	1.0	1/	6.7
Peru	8.1	6	31.5
Pittsfield	41.3	29	97.2
Richmond	4.5	3	23.7
Washington	7.3	5	18.9
Windsor	11.9	8	34.0
TOTAL	144.7	100	

1/ Contributing drainage area of town is less than 1% of the study area - Cheshire, Lenox, and New Ashford combined contribute 1.5 sq. mi. or 1% of study area.

The Upper Housatonic River study area includes the drainage areas of the East, West and Southwest Branches and a portion of the Housatonic River. The confluence of the Southwest and West Branches form the Housatonic River in the southern part of the City of Pittsfield. The East Branch, which is the largest of the three branches, enters the Housatonic River downstream of its origin, also within Pittsfield.

The East Branch of the Housatonic River originates in a swamp in the southern part of Hinsdale, and flows northwest through Hinsdale to Center Pond in Dalton. From the outlet of Center Pond, the East Branch flows in a westerly and then southwesterly direction through Pittsfield to the Housatonic River. The East Branch drains 70.2 square miles (44,900 acres) or 48.5% of the study area.

The major tributaries in the Town of Hinsdale are Cady Brook, Bennett Brook and Frisell Brook. Bennett Brook, (the outlet of Ashmere Lake) and Cady Brook flow into the Hinsdale Swamp. Frisell Brook is the outlet for Plunkett Reservoir, and enters the East Branch about one-half mile downstream from the swamp outlet or approximately three-quarters of a mile southeast of Hinsdale center. Plunkett Reservoir and Ashmere Lake are primarily used for recreation. The Massachusetts Department of Natural Resources owns Ashmere Lake.

Wahconah Falls Brook and Cleveland Brook are the major tributaries in the Town of Dalton, and both serve as outlets for reservoirs. Wahconah Falls Brook flows southwesterly from Windsor Reservoir into Center Pond. Cleveland Brook flows westerly from Cleveland Brook Reservoir into the East Branch slightly upstream of Center Pond. Both reservoirs are part of the Pittsfield water supply system, while Center Pond has traditionally been used for industrial purposes and recreation.

Unkamet Brook flows southerly through the Coltsville section of Pittsfield and enters the East Branch at Adams Junction.

Brattle Brook drains two large swamps in the vicinity of Yankee Orchards and flows northerly where it empties into the East Branch slightly upstream of the confluence of the East Branch and the Goodrich Pond outlet.

The West Branch originates in Pontoosuc Lake in the northern section of Pittsfield. The West Branch flows southerly to its confluence with the Southwest Branch, thereby forming the Housatonic River. This confluence is approximately one mile upstream from where the East Branch empties into the Housatonic River. The West Branch drains 36.1 square miles (23,100 acres) or 25% of the study area.

The major tributaries to the West Branch are Town Brook and Onota Brook. Town Brook flows southerly from New Ashford through Lanesborough and

empties directly into Pontoosuc Lake. Onota Brook is the outlet from Onota Lake, and flows southeasterly to its confluence with the West Branch in the vicinity of Wahconah Park.

Pontoosuc and Onota Lakes are both enhanced (by structures) great ponds, primarily used for recreation. Onota Lake is also an emergency water supply for the City of Pittsfield.

The Southwest Branch is formed by the confluence of Shaker Brook and the outlet from Richmond Pond, in the southwest corner of Pittsfield. The Southwest Branch flows northeasterly and then easterly to its confluence with the West Branch, thus forming the Housatonic River. The Southwest Branch drains a total of 23.1 square miles (14,800 acres) or 16% of the study area.

There are four brooks which are major tributaries to the Southwest Branch and all flow in a southeasterly direction. Mount Lebanon Brook drains directly into Richmond Pond. Richmond Pond is also an enhanced great pond, with recreation being the primary use. Shaker Brook, Jacoby Brook and Smith Brook all originate in the Town of Hancock and the Pittsfield State Forest, and empty into the Southwest Branch, with Shaker Brook confluence considered the point of origin of the Southwest Branch.

The Housatonic River flows easterly from the confluence of the West and Southwest Branches for approximately one mile to the confluence with the East Branch. The watershed area at this point is 129.6 square miles (83,000 acres) or 90% of the study area. The river then flows southeasterly and then easterly, before turning south at Holmes Road, where it continues to flow in a southerly direction past the Pittsfield-Lenox boundary.

The major tributaries within this reach are Wampenum Brook and Sackett Brook. Wampenum Brook drains in a northerly direction from the Bousquet Ski Area, then flows easterly until it empties into Morewood Lake. The outlet from Morewood Lake flows directly into the Housatonic River. Sackett Brook originates in the northern portion of the Town of Washington and drains northward into Upper Sackett Reservoir. The brook then passes through Lower Sackett Reservoir before flowing west to its confluence with the Housatonic River. The total drainage area of Sackett Brook is 9.4 square miles and includes Ashley Brook which drains Ashley Lake and Ashley Reservoir.

Morewood Lake is a private pond used for recreation, while Upper Sackett and Ashley Reservoirs and Ashley Lake are part of the Pittsfield water supply system.

Table 2 lists the drainage areas of the major tributaries within the study area.

TABLE 2

DRAINAGE AREAS OF MAJOR TRIBUTARIES

FLOOD HAZARD ANALYSES
UPPER HOUSATONIC RIVER

Major Tributary	Drainage Area Sq. Mi.	Cumulative Drainage Area at Confluence - Sq. Mi. 1/
To East Branch		
Cady Brook	4.0	9.5
Bennett Brook	8.8	18.3
Frisell Brook	2.8	23.3
Cleveland Brook	2.8	30.5
Wahconah Falls Brook	19.3	49.8
Unkamet Brook	2.8	62.6
Brattle Brook	3.5	66.4
To West Branch		
Town Brook	12.0	21.6
Onota Brook	11.1	34.0
To Southwest Branch		
Mount Lebanon Brook	3.2	--
Shaker Brook	2.9	10.4
Jacoby Brook	4.3	16.7
Smith Brook	3.3	20.1
To Housatonic River		
Southwest Branch	23.1	59.1
West Branch	36.1	59.1
East Branch	70.2	129.6
Wampenum Brook	2.3	132.0
Sackett Brook	9.4	142.0

1/ Includes drainage areas from other contributing watersheds.

Geology -- The Upper Housatonic Study Area lies within three major Physiographic Provinces; the Berkshire Hills, the Hoosic-Housatonic Limestone Valley, and the Taconic Range.

The Berkshire Hills Province includes the hilly upland and tributary headwater areas, deeply dissected by narrow V-shaped valleys of the East Branch and Wahconah Falls Brook. Bedrock in the uplands consists of granitic gneiss with lenses of schist and limestone in certain localities. This bedrock often is covered by a thin veneer of dense glacial till (silty sand with gravel, cobbles, and boulders) or looser englacial drift (sand and gravel with many cobbles and boulders). Other glacial deposits generally are confined to the deeply incised stream valleys, and consist of glacial outwash (terrace deposits of poorly graded sand and gravel) and lacustrine deposits (silt and fine sand).

Bedrock usually is close to the ground surface in the Berkshire Hills Province. However, considerable thicknesses of sand and gravel occur in the valley of the Housatonic River between Muddy Pond in the Town of Washington and Hinsdale Center. The sand and gravel occur as partially dissected, flat-topped terraces of glacial outwash or as small, hummocky hills of ice-contact deposits. Lacustrine deposits probably are present beneath the large swampy portions of the valley floor.

The Hoosic-Housatonic Limestone Valley Province is the largest in the study area and comprises the low lying lands and the intermediate upland areas, bounded by the Berkshire Hills and Taconic Range Provinces. The Hoosic-Housatonic Valley bedrock is dolomite and limestone. The limestone is cavernous in many places. The presence of knobs and ridges of bedrock and deep, sediment-filled depressions suggest a highly irregular bedrock surface. Glacial outwash sand and gravel is quite abundant in this Physiographic Province and locally may attain thicknesses exceeding 50 feet. Lacustrine silt and sand also is abundant, especially beneath swamp surfaces and low flat areas on the valley floor. Glacial till occurs on the flanks of some of the bedrock hills and probably underlies the other glacial deposits in many places.

The Taconic Province lies on the western fringe of the study area and includes the hilly upland - tributary headwater areas of the Southwest and West Branches and the Northwest portion of Town Brook. The topography closely resembles that in the Berkshire Hills, and consists of hilly uplands dissected by steep, V-shaped stream valleys. However, bedrock in the Taconic Range more closely resembles the bedrock in the Hoosic-Housatonic Valley, rather than the Berkshire Hills, and consists of relatively soft schist and cavernous limestone. Only a narrow area of the Upper Housatonic River Watershed lies within the Taconic Range Physiographic Province.

Recent erosion and deposition is of minor importance in the watershed.

Deposition is confined to minor amounts of organic deposits in swamps and relatively thin sections of sandy valley fill in stream valleys. Recent deposits are found more commonly in the Hoosic-Housatonic Valley than in the steeper gradient tributary valleys in the Berkshire Hills and Taconic Range. However, swamps occur locally along these upland tributaries, occupying small depressions in the valley floors which were excavated during glaciation.

Soils -- The upland soils are generally very stony, well drained and shallow to bedrock. Other areas are stony, sandy glacial till deposits with a hardpan layer in the subsoil. These soils, because of the texture and permeability, are subject to minor erosion and sediment problems. The flood plain soils range from excessively drained to very poorly drained, but generally are poorly drained mineral and organic soils.

A soils report entitled "Soils and Their Interpretations for Various Land Uses" was prepared by the Soil Conservation Service for the City of Pittsfield in March 1969. The purpose of the report was to provide information about the soils in Pittsfield to enable planners, city boards, and others to make sound land use decisions.

A general description of the soil types prevalent in flood-prone areas within the study area is given in table 12, which follows plate 13.

Identification of the major and minor soil-series in the flood plains, based on dominance, is contained in the Section IDENTIFICATION OF FLOOD-PRONE AREAS. If more soils information is sought for a specific location, not covered by the Pittsfield soils report, the Soil Conservation Service field office in Pittsfield should be consulted.

Climate -- The study area has the humid climate and annual temperature characteristic of the North Temperate Zone. The mean annual temperature is about 46°F. The normal growing season of 140 days usually extends from early May to late September. The average annual precipitation is 45 inches. At the Pittsfield gage, the maximum long-term mean monthly precipitation is 4.9 inches in July and the minimum is 2.5 inches in February.

Flooding can occur annually as a result of melting snows and spring rains, with localized flooding caused by summer thunderstorms. The major floods, however, have been associated with mulitple-day rainfalls including tropical storms and hurricanes.

Land Use -- Presently, the estimated land use in the study area is 11% urban, 7% cropland and pasture, 70% forests, 3% open water, and 9% other miscellaneous uses.

Economic Data

Transportation Network -- Principle U.S. and state highways provide access to the study area from the major population centers in the Northeast, such as: Albany, 38 miles west; Hartford, 75 miles southeast; Boston, 137 miles east; and New York City, 155 miles south. With Interstate 90 (Massachusetts Turnpike) passing within ten miles of the southern study area boundary, good access is provided to the City of Pittsfield which is the major residential, commercial and industrial center in the study area. U.S. Routes 7 and 8 are the principle north-south highways and Massachusetts Routes 9 and 20 are the primary east-west arteries within the study area.

A network of town roads compliments these main highways in providing further mobility for area residents as well as tourists, whose trade is an increasingly important role in the area economy.

Air travel within the study area is limited but important. The Pittsfield Municipal Airport can accommodate many of the smaller type commercial and executive aircraft.

Rail service remains a significant facet of the area's transportation network. Many industries take advantage of rail freight to transport both raw materials and finished products.

Rail, air and highway transportation have brought about substantial economic growth within the area. They have, in doing so, also increased pressures for flood plain development by requiring additional consumer facilities and services.

Population -- According to U.S. Census figures, the population of the four main communities within the study area (Pittsfield, Dalton, Lanesborough and Hinsdale) increased nearly 11.2% from 1950 to 1960 and less than 1% in the following ten year period. However, Pittsfield decreased in population from 1960 to 1970. This decrease of about 850 people amounted to 1.5%.

The three remaining communities experienced an 11.9% increase during the same period. These figures indicate a current trend of migration from urban to rural areas as well as a declining birth rate.

Based on 1970 U.S. Census figures, the current study area population is estimated to be 66,400. The following table shows the population for the communities within the study area.

Community	Total Community Population (1970)	Estimated Community Population Within Study Area	Percent of Study Area Population
Cheshire	3006	1/	--
Dalton	7505	6200	9.3
Hancock	675	200	.3
Hinsdale	1588	1600	2.4
Lanesborough	2972	2200	3.3
Lenox	5804	100	.2
New Ashford	183	1/	--
Peru	256	100	.2
Pittsfield	57020	55500	83.6
Richmond	1461	350	.5
Washington	406	100	.2
Windsor	468	50	.1
TOTALS	81344	66400	2/

1/ Less than 25
2/ Does not equal 100 due to rounding

It is expected that the rural towns will continue to grow due to increased demand for suburban living. Projected industrial and commercial expansion in the City of Pittsfield is expected to create many new job opportunities for both local and neighboring town residents.

According to a recent updating of the Pittsfield Master Plan, the town population "has only reached a temporary plateau and in the 1970's will again begin to climb, but at a slower rate than previously."

In the past, increased population pressure has caused considerable flood plain development. A comparison of photographs and maps shows that within the last twenty five years there has been a great increase in the number of commercial and residential properties susceptible to flood damage within the study area.

Resources -- Of the four major communities, only Pittsfield is highly commercial and industrial. Lanesborough and Hinsdale are primarily rural residential areas, while Dalton is moderately industrialized.

Since over 83% of the study area population resides in Pittsfield, this community is also classified as highly urban residential.

Historically, many industrial firms were built on the low lying areas adjacent to streams because of their dependence on water power. Many of these industries have found it is less expensive to expand existing facilities than to relocate. This has resulted in a significant increase in the amount and value of potential damageable property on the flood plains.

Within the last 25 years, most pressure for development of low lands has come from commercial firms. Increased mobility and the "one stop shopping" trend have accelerated the commercial development in Pittsfield. For example, shopping centers have been established on the flood plain in the Cadwell Road - Barker Road - Route 20 area along the Southwest Branch, and in the Coltsville section of Pittsfield along the East Branch and Unkamet Brook.

Flood plains have also experienced some residential pressures. There has been recent building along Unkamet Brook in Pittsfield and around lakes and ponds throughout the study area.

Prospects for limiting or restricting future flood plain development have been dependent on local zoning ordinances, and by laws with local and state regulatory influence exerted via the Wetlands Protection Act (The Hatch Act), Chapter 131, Section 40 of the General Laws of Massachusetts. Enforcement of this statute has been hindered by the general lack of supporting flood hazard information.

The present flood plain regulations are discussed in more detail in a separate section of this report.

Other related water resource uses that can have a direct influence on development of flood plain areas are water supply and sewage disposal.

One of the most valuable resources in the area is the public water supply. The following information was obtained from "Water Supply and Sewerage Berkshire County, Massachusetts, Stage I Inventory and Future Needs," The Berkshire County Regional Planning Commission, Curran Associates Inc., 1969.

At the present time Pittsfield is the only community within the study area having immediate water supply shortages. All of Pittsfield's water for consumption is supplied by surface waters from the Cleveland, Farnham, Sandwash, Sackett, Ashley, and New Lower Ashley Reservoirs. In addition, Onota Lake serves as an emergency source. Many of the city's industries depend upon private groundwater supplies which are also inadequate. Pittsfield is now searching for other water sources including groundwater supplies.

Although the three major towns are in no immediate danger of water shortages, future projections for Hinsdale indicate that present supplies

will be unable to meet average daily consumption requirements by 1995. Both Hinsdale and Dalton rely entirely on surface water for consumption purposes while Lanesborough depends solely upon groundwater supplies.

The search for new water supplies within the study area may have detrimental effects on the flood plain through increased use. Additional water will give many firms the opportunity to expand. Since much of the remaining land available for development is on the flood plain, more water could well mean increased flood plain developmental pressures.

In addition to water supply limitations, sewage treatment needs rate a high priority within the study area.

Presently, Pittsfield and Dalton utilize the Pittsfield sewage treatment facilities. A new two-stage biological treatment facility, utilizing high-rate trickling filters and the activated sludge process, has been designed and is presently under review by the Massachusetts Division of Water Pollution Control. The plant has been designed to serve the estimated population in the year 1995, and to adequately treat the following flows: 11.45 mgd from Pittsfield, 2.15 mgd from Dalton, 1.65 mgd from Lanesborough, 0.75 mgd from North Lenox, 0.74 mgd from Hinsdale, and 0.22 mgd from a major industrial complex, totaling 16.96 mgd.

There will be a 90% State Grant of approximately 12 million dollars for this project.

Hinsdale has plans under review by the Division for the necessary interceptors to connect to the Pittsfield plant. Estimated completion date of the new plant is April 1976.

Water quality is of prime concern to an area with limited water supplies. Recently, the Massachusetts Division of Water Pollution Control evaluated water quality within the Housatonic River Basin, which included the Upper Housatonic study area. The findings indicate a need for improvement of water quality in some streams. The most immediate problems exist in the East Branch from Old Windsor Road in Dalton to its confluence with the Housatonic River; the West Branch from Wahconah Park to the confluence with the Southwest Branch in Pittsfield; the Southwest Branch from Cadwell Road to the West Branch confluence; and the Housatonic River from Pittsfield to the downstream study area boundary. All of the preceding reaches have been defined and classified as type "C" by the Division of Water Pollution Control. A type "C" stream is defined as being "suitable for recreational boating; habitat for wildlife and common food and game fishes indigenous to the region; certain industrial cooling and process uses; under some conditions acceptable for public water supply with appropriate treatment. Suitable for irrigation of crops used for consumption after cooking."

Future prospects for improved water quality in the study area are good. Both Hinsdale and Pittsfield have made plans for new or additional water

pollution control facilities to improve quality in the aforementioned type "C" reaches.

With improved water quality, the flood plain lands adjacent to the affected streams would afford a much larger variety of recreational uses, especially if swimming waters are once again attractive. Recreational use of flood plains tends to limit development, thereby relieving encroachment pressures.

The majority of land in the study area is in private ownership, while publicly owned lands account for approximately 11% of the study area. However, of the flood plain areas studied, less than 5% were publicly owned. There are no large federal land holdings within the study area.

All of the communities in the study area are members of the Berkshire County Regional Planning Commission, which has jurisdiction covering the thirty-two municipalities which comprise Berkshire County. The towns of Dalton, Lanesborough, and Lenox are included in the Pittsfield standard metropolitan statistical area.

Soil, water, and related conservation work is carried out through the Berkshire Conservation District. Assistance is provided to individual landowners, towns, and others by the Soil Conservation Service and other federal and state agencies through working agreements with the District. Of particular importance to management of flood hazard areas is the assistance provided to Massachusetts towns in preparing Town Operational Soils Reports and Town Natural Resource Inventories.

Town Operational Soils Reports contain an inventory of soils with interpretations for various uses and are of primary importance in guiding planners in making sound land use decisions. The Operational Soils Report for the City of Pittsfield has been completed.

Town Natural Resource Inventories, in progress in Pittsfield and Dalton, contain an inventory and appraisal of natural resource potentials as related to the town's land use objectives, problems and needs. The inventory is presented in a report to the town and serves as a basis for an action plan by the town for development, protection and management of natural resources. Such a report was prepared and presented to the Town of Richmond in 1967. In addition to the inventory report, technical assistance is provided through the Conservation District to implement planned measures.

IDENTIFICATION OF FLOOD-PRONE AREAS

General

The 100-year flood plain delineated within the flood-prone areas in this report cover approximately 4,150 acres or 4.5% of the study area, exclusive of the normal surface areas of the major ponds and lakes contained therein, and represents 33.0 miles of streams studied. Other flood-prone areas that were not delineated include many smaller tributary streams and upland wetlands. Lesser flood damage potential was the major factor in excluding these areas from this study.

The delineated flood-prone areas include major floodwater damage and natural storage areas. These areas have been grouped in reaches to facilitate identification.

The flood plain reaches are listed in Table 3 with their upstream and downstream limits, and the length of streams studied within the primary reaches (i.e. East Branch, West Branch, etc.).

Information on selected stream crossings within the flood-prone areas is presented in Tables 7, 8, and 9. Information pertaining to the major reservoirs and river dams within the study area is presented in Table 10.

East Branch

Hinsdale Swamp Reach -- The 100-year flood plain delineated in this reach extends from Bullards Crossing Road to the Grist Mill Dam and lies entirely within the Town of Hinsdale. Included in this flood plain area is the majority of the large swamp south of the Massachusetts Route 8 crossing, hereafter referred to as Hinsdale Swamp. This flood plain is estimated to be 750 acres at the 100-year flood elevations. Although Hinsdale Swamp has a defined channel outlet for low and normal flows upstream of the Massachusetts Route 8 bridge, in Hinsdale center the flood elevations are generally controlled by backwater from the Maple and Main Street bridges and the Grist Mill Dam. The low profile of the Massachusetts Route 8 road, east of the bridge, allows floodwaters to flow around the bridge, resulting in no further increase in floodwater elevations in the swamp. This is significant in relation to the Penn Central Railroad embankment, which bisects Hinsdale Swamp in a north-south direction, because the railroad tracks are essentially above the 100-year flood plain.

The major damage center in this reach is in the vicinity of Maple Street, Hinsdale, and about 4,000 feet along Massachusetts Route 8. Approximately six residences and two or three commercial properties would be affected.

TABLE 3

FLOOD PLAIN REACH LIMITS

FLOOD HAZARD ANALYSES
UPPER HOUSATONIC RIVER

REACH	MILES STUDIED	REACH LIMITS [2/]
EAST BRANCH	16.3	
Hinsdale Swamp		Bullards Crossing Road to Grist Mill Dam
Center Pond		Grist Mill Dam to Center Pond Dam
Mill		Center Pond Dam to Government Mill Dam
Coltsville		Government Mill Dam to East Street
Brattle Brook		East Street to footbridge
Silver Lake		Footbridge to Housatonic River
WEST BRANCH	7.8	
Town Brook [1/]		North of Bridge Street, Lanesborough
Pontoosuc Lake		Bridge Street to Pontoosuc Lake Dam
Wahconah Park		Pontoosuc Lake Dam to Southwest Branch
Onota		Onota Lake to West Branch
SOUTHWEST BRANCH	5.6	
Richmond Pond		Richmond Pond and Southwest wetlands
West Pittsfield		Shaker Brook to Tillotsons Dam (breached)
Plaza		Tillotsons Dam (breached) to West Branch
HOUSATONIC RIVER	3.3	
Sackett		Confluence of West and Southwest Branches to Pittsfield-Lenox Boundary

1/ No flood plain was delineated for Town Brook upstream of Bridge Street. However, limited flood stage data is presented.

2/ Refer to Plate 2 (follows page 22) for reach locations.

Present development within this flood plain is limited and future development pressure is not evident at this time.

The most important hydrologic feature of this flood plain would seem to be Hinsdale Swamp, a 1,075 acre natural storage area for floodwaters. The Penn Central Railroad separates Cady Brook and the East Branch through the swamp, with both streams flowing northerly. There are very few large open areas within the swamp The vegetative cover is a combination of thickets, wooded areas, and occasional small grass areas. Many species of wildlife are abundant. The loss of this natural storage area without adequate storage compensation, would tend to increase flood stages and consequent damages in this flood plain and the flood plain reaches downstream.

The predominant flood plain soils are the Muck and Rumney series, with minor areas occupied by Scarboro and Saco series soils.

Center Pond Reach -- This flood plain extends from the Grist Mill Dam in Hinsdale to Center Pond Dam in Dalton, and includes the Wahconah Falls Brook flood plain to a point upstream of North Street. The East Branch drops a total of 292 feet between the two dams, (a distance of about 4½ miles) with 250 feet occuring between Grist Mill Dam and East Housatonic Street. The stream is well entrenched down to East Housatonic Street, with the exception of the area in the vicinity of Old Dalton Road. The flood plain flattens slightly approaching Windsor Road, and then expands to about 800 feet in width at the Cleveland Brook confluence. West of Orchard Road the flood plain is the storage area of Center Pond. Of the approximately 175 acres delineated in this reach, about 90 are in the vicinity of Center Pond in Dalton.

There are eight stream crossings over the East Branch in this reach, six of which are in Dalton. Of these roads, Old Dalton Road, Massachusetts Route 8 (vicinity of town boundary), Windsor Road, and Main Street in Dalton would be overtopped by 100-year flood flows. The Windsor Road bridge is presently being replaced.

Massachusetts Route 8 closely parallels the stream to the vicinity of Windsor Road. Through this segment of the reach the stream is generally tree-lined and the major soil series is Walpole with smaller areas of Rumney. The soils in the flood plain between Windsor Road and Orchard Road are in the Rumney and Walpole series, with the Rumney series being dominant. The flood plain surrounding Center Pond has major areas in the Rumney and Podunk series, with smaller areas of Walpole and Ninigret series soils. The exposed land area within Center Pond is a result of sedimentation, and may not resemble the soils previously mentioned.

Development within the flood plain varies from very little in Hinsdale to significant in Dalton. The area adjacent to Center Pond is lined with residences, including multi-family dwellings. Several of these buildings are within the delineated 100-year flood plain. Flood flows overtopping Main Street would jeopardize several commercial buildings,

before the flows reentered the channel.

Mill Reach -- Center Pond Dam in Dalton and Government Mill Dam in Pittsfield define the stream limits of this reach. The stream drops 125 feet and passes over four other dams within this 2¼ mile reach. The 100-year flood plain only averages 200 feet in width above South Street and 300-500 feet between South Street and the Government Mill Dam. This represents an area of approximately 75 acres. The two stream crossings (East Housatonic Street and South Street) are not considered to be major constrictions. However, none of the six dams have the spillway capacity to pass the anticipated 100-year flood flows.

Development within this reach is extensive and primarily industrial. There are five mill complexes located on the north side of the river and all are subject to flooding, to varying degrees. There are also about six residences within the delineated flood plain.

Future development within this flood plain would appear to be limited to expansion of present facilities, due to topography, present industrial use and zoning.

The major soil series between Center Pond Dam and South Street are Rumney and Podunk, with smaller areas comprised of Walpole and Ninigret soils. West of South Street to the Government Mill Dam, the primary soil series in the flood plain is Limerick, with minor areas of Winooski.

Coltsville Reach -- This flood plain reach extends from the Government Mill Dam to the East Street crossing. The area delineated also includes the Unkamet Brook flood plain south of Crane Avenue. The 100-year flood plain is about 260 acres, of which 85 acres are considered to be the Unkamet Brook flood plain. The stream gradient drops twenty-one feet in about 1½ miles, with a 12 foot drop in the first 2000 feet below the Government Mill Dam. The USGS stream gaging station No. 011970 is located 750 feet west of the Government Mill Dam at Hubbard Avenue. The station's period of record dates from March 1936 to the present.

There are four stream crossings over the East Branch within this reach, including the Penn Central Railroad crossing. There are no dams within this reach, although some of the stream crossings can create similar backwater conditions. Unkamet Brook has seven stream crossings in its flood plain, all of which are culverts or culvert systems. Without exception, the Unkamet Brook crossings are constrictions for floods of a 10-year or greater magnitude.

The predominant soils in the flood plain of the East Branch are the Limerick and Winooski series, with smaller areas of the Hadley series. Within the Unkamet Brook flood plain the soils are of the Muck series and made land type.

The vegetative cover, where it exists, is open meadow with thin wood stands on the eastern fringe. Within the Unkamet Brook flood plain the vegetative cover is meadow with brushy thickets.

The present level of development at or below the 100-year flood elevation is extensive and consists of commercial or industrial establishments. The three main arteries through the area are: Massachusetts Route 9, Merrill Road and East Street, in addition to two lines of the Penn Central Railroad. There are two major shopping centers south of Route 9 (K-Mart and Bradlees) which are subject to flooding. The parking areas may also experience frequent flooding from localized storms due to the large areas of pavement and the capacity of the drainage systems. Other facilities within the flood plain include industrial plants and small and large commercial buildings. There are a few residences within the flood plain, but the only cluster of homes is located north of East Street.

Future development pressure in this area seems to be quite high. The Pittsfield Master Plan, 1970, anticipates "the need for 800 additional acres for industrial expansion," and projects most of this will occur as "an extension of the present complex in the north east sector of the City," which is within this flood plain reach.

Brattle Brook Reach -- Approximately 680 acres of flood plain was delineated between East Street and the footbridge east of Newell Street, and includes land adjacent to Goodrich Pond. The East Branch meanders through this reach a distance of about one mile, but the stream gradient drops only two feet.

This area would be affected by backwater created by the many stream crossings in the Silver Lake Reach. This enables the Brattle Brook flood plain to function as a storage area, consequently reducing peak discharges farther downstream. Any significant loss of storage in this area would result in higher flood stages in this flood plain and subsequent flood plains downstream.

The major soils in the flood plain in the vicinity of the East Branch are the Limerick and Winooski series, while there are smaller areas of the Hadley series. The storage area of Brattle Brook and land surrounding Goodrich Pond are basically peat deposits.

Presently, the vegetative cover is a balance of open land (meadow and small grains), brushy thickets and woodland.

The present level of development is near the critical stage, meaning that additional development or expansion will likely be subject to frequent flooding. Goodrich Pond is surrounded by residential subdivisions and this development is extending toward Brattle Brook.

Silver Lake Reach -- This reach concludes the East Branch flood plain, extending from the footbridge (east of Newell Street) to the Housatonic River confluence, and consists of approximately 260 acres. The stream gradient drops 12 feet in approximately 2 1/3 miles. There are no remaining dams within this reach, but there are five stream crossings, which at times may cause a backwater condition.

The predominant soil series in the flood plain is Walpole, with smaller areas comprised of the Rumney series, and made land.

Due to the extent of urbanization within this flood plain, vegetative cover in most areas is sparse. The open areas are basically limited to residential lawns with occasional shade trees, while the stream banks have scattered clumps of alders and deciduous trees.

The present development within this flood plain is a combination of industrial, commercial, and residential. The present level of development is high; future expansion within the flood plain appears limited.

The north side of the flood plain paralleling East Street is the industrial sector in this reach. The remaining development above Pomeroy Avenue is a combination of residential and small commercial establishments with associated public buildings and grounds. Flood damages from a 100-year flood would be distributed throughout this reach, rather than being centered in one vicinity.

West Branch

Town Brook Reach -- The flood plain was not delineated within this reach, but since flood stage data was developed for three selected locations, a brief description of the reach is presented.

The reach extends from the New Ashford - Lanesborough Town boundary south to Bridge Street in Lanesborough, generally parallel with Massachusetts Route 7. The reach is approximately 5 miles long and the stream gradient drops about 390 feet. For the most part, the channel is clear of debris.

Large areas of the Winooski soil series are expected to occupy the flood plain, with smaller areas of the Limerick series.

The vegetative cover consists of pasture, hayland, shrub thicket and woodland.

There is no existing damage center within this reach. Damages probably would be limited to stream crossings, roads and scattered residences.

Pontoosuc Lake Reach -- Approximately 300 acres were delineated at the 100-year flood elevations between Bridge Street in Lanesborough and the Pontoosuc

Lake Dam in Pittsfield, excluding the normal surface area of Pontoosuc Lake. This reach is about 2 3/4 miles long, and the average width of the flood plain north of the lake is 1000 feet. There are four stream crossings over Town Brook including Bridge Street, and one crossing at the northwest corner of the lake. There is a natural storage area off the northwest shore of the lake, at the mouth of Secum Brook. This area is an integral part of the storage area of Pontoosuc Lake, as is the flood plain immediately north of Bull Hill Road on Town Brook.

The predominant soil series expected to be found between Bridge Road and Bull Hill Road, is Muck and Limerick, with lesser amounts of the Winooski series.

The vegetative cover along the Town Brook portion of this flood plain is a combination of shrub thicket and open areas. The shrub thicket areas consist primarily of speckled alder, silky dogwood and wild spirea. The open areas are recently abandoned agriculture lands which are now in tall grasses and weeds. The area provides a good habitat for song and game birds.

The two wetland areas identified as part of the Pontoosuc storage area provide good habitat for wetland wildlife including waterfowl, amphibians, reptiles, warm water fishes, song birds, and game birds. The storage area to the northwest is surrounded by woodland. Open areas along the channel contain clumps of alder. North of Bull Hill Road the channel is fringed by cattail and alder. Wood duck nesting boxes have been erected in both areas.

Existing development is centered around Pontoosuc Lake, with U.S. Route 7 fringing the eastern shore of the lake; additional residential development around the lake is somewhat limited.

Wahconah Park Reach -- The area delineated at the 100-year flood elevations consists of approximately 205 acres. The reach length is about 3 3/4 miles from Pontoosuc Lake Dam to the Southwest Branch, and the stream gradient drops about 120 feet. There are two dams in addition to Pontoosuc Dam within this reach; Bel Air and Tel Electric Dams. The West Branch is well entrenched between Pontoosuc Lake Dam and Bel Air Dam. There are ten major stream crossings over the West Branch in addition to a high Penn Central Railroad trestle. The widest section of the flood plain, about 2000 feet, is in the vicinity of Wahconah Park, approximately defined between the Linden Street and Wahconah Street crossings. Onota Brook enters the West Branch in this area.

The principal soils in the flood plain would probably be the Muck and Limerick series, with smaller areas of Winooski series soils.

The vegetative cover is primarily restricted to the banks and fringes of the channel and is comprised of deciduous trees, alders, and shrubs.

Vegetative cover is less obvious north of Linden Street, in the dense residential areas.

This flood plain is quite fully developed. Wahconah Park and the adjoining cemetery remain as the only large, open areas within the reach. The urban developments are basically a combination of commercial and residential buildings. The complexion of the present developments may change in the future due to redevelopment programs, but the level of development with relation to the flood plain probably will not increase significantly. This does not mean that the flood damage potential will remain the same; it will probably increase due to new buildings of higher value. The damage center is primarily south of Pontoosuc Avenue, and extends fairly uniform through the remainder of the reach. Several of the stream crossings would be over-topped by 100-year flood flows, and a few by 10-year flood flows.

Southwest Branch

Richmond Pond Reach -- This flood plain is comprised of land adjacent to Richmond Pond and the wetlands lying southwest of Richmond Pond. Of the 170 acres within the 100-year flood plain, approximately 150 acres represent the wetland area. This natural floodwater storage area lies entirely in the Town of Richmond; the Pittsfield-Richmond boundary bisecting Richmond Pond. The Penn Central Railroad runs northeast-southwest, divides the storage area and passes Richmond Pond on the west side. The major access roads to Richmond Pond are Massachusetts Route 41 on the west, U.S. Route 20 on the north and Barker Road on the east side.

Vegetation within the wetland storage area is comprised of cattails and other wetland plants, while the perimeter is heavily wooded. This wetland provides good habitat for many wildlife species.

The flood damage center is the shore line of Richmond Pond and private roads. The Penn Central Railroad bed is subject to flood damages in the vicinity of the northwest portion of Richmond Pond.

West Pittsfield Reach -- This flood plain reach is approximately 3½ miles in length and extends from Shaker Brook (west of the Penn Central Rail-road) to the recently (1972) breached Tillotson's Dam. The storage area on Shaker Brook, west of the railroad bed, and the storage areas on Jacoby Brook and Smith Brook were also delineated at the 100-year flood elevations. These three storage areas are formed by constrictive culverts and the Penn Central Railroad embankment. Of the 295 acres within the 100-year flood plain, these three storage areas account for 135 acres. From the stream crossing over Shaker Brook to Tillotson's Dam, the stream gradient drops about 110 feet, 20 feet of which occurs at the re-mains of an old dam northeast of Melbourne Road. There is an additional,

smaller dam upstream of the lower Hungerford Street crossing. This dam serves as a grade control structure at above normal flows. There are nine stream crossings over the Southwest Branch within this reach, of which U.S. Route 20, which crosses the stream twice, is the major artery.

The three storage areas on Shaker, Jacoby and Smith Brooks, have a significant effect on discharges on the Southwest Branch, downstream from their respective confluences. The reduction of discharges is most pronounced in the range of 10-year flood flows, but is also effective in reducing 100-year flood flows.

The storage area on Shaker Brook has been identified as an excellent wildlife habitat. The flood plain area has approximately 1½ acres of open water containing floating plants and various rushes and sedges. The perimeter is wooded with such species as speckled alder, willow and red maple. The area is suitable for waterfowl, song birds, and other wetland wildlife. The adjacent upland provides a good habitat for woodcock. The predominant soil in this storage area is the Muck series, with smaller areas of the Saco series.

Between the dam at Richmond Pond and the upper U.S. Route 20 crossing, the soils in the flood plain are primarily in the Saco and Limerick series, with some areas of the Fredon series. The Jacoby Brook storage area has Peat as its major soil with small areas of Fredon. From the upper U.S. Route 20 crossing to Tillotson's Dam, the primary soils in the flood plain are in the Limerick and Winooski series, with minor quantities of Muck.

The flood plain vegetative cover in the open areas is largely tall herbaceous plants and woody thickets. The wooded areas are thin stands, except east of the railroad crossing.

Flood damages could occur at the stream crossings and to scattered residences throughout the reach.

Plaza Reach -- The reach extends from the breached Tillotson's Dam to the confluence with the West Branch. The flood plain at the 100-year flood elevations is about 130 acres, 110 of which are a result of backwater from the Penn Central Railroad crossing east of Barker Road. West or upstream of the railroad crossing, the flood plain is moderately developed, with heavy concentrations of commercial and residential buildings north of U.S. Route 20. This area would be the main damage center from flood flows of the 100-year magnitude. There are three stream crossings in addition to the railroad, including a footbridge between Barker and Cadwell Roads. This flood plain reach has the most potential flood damages on the southwest Branch, centered in the vicinity of the Pittsfield Plaza.

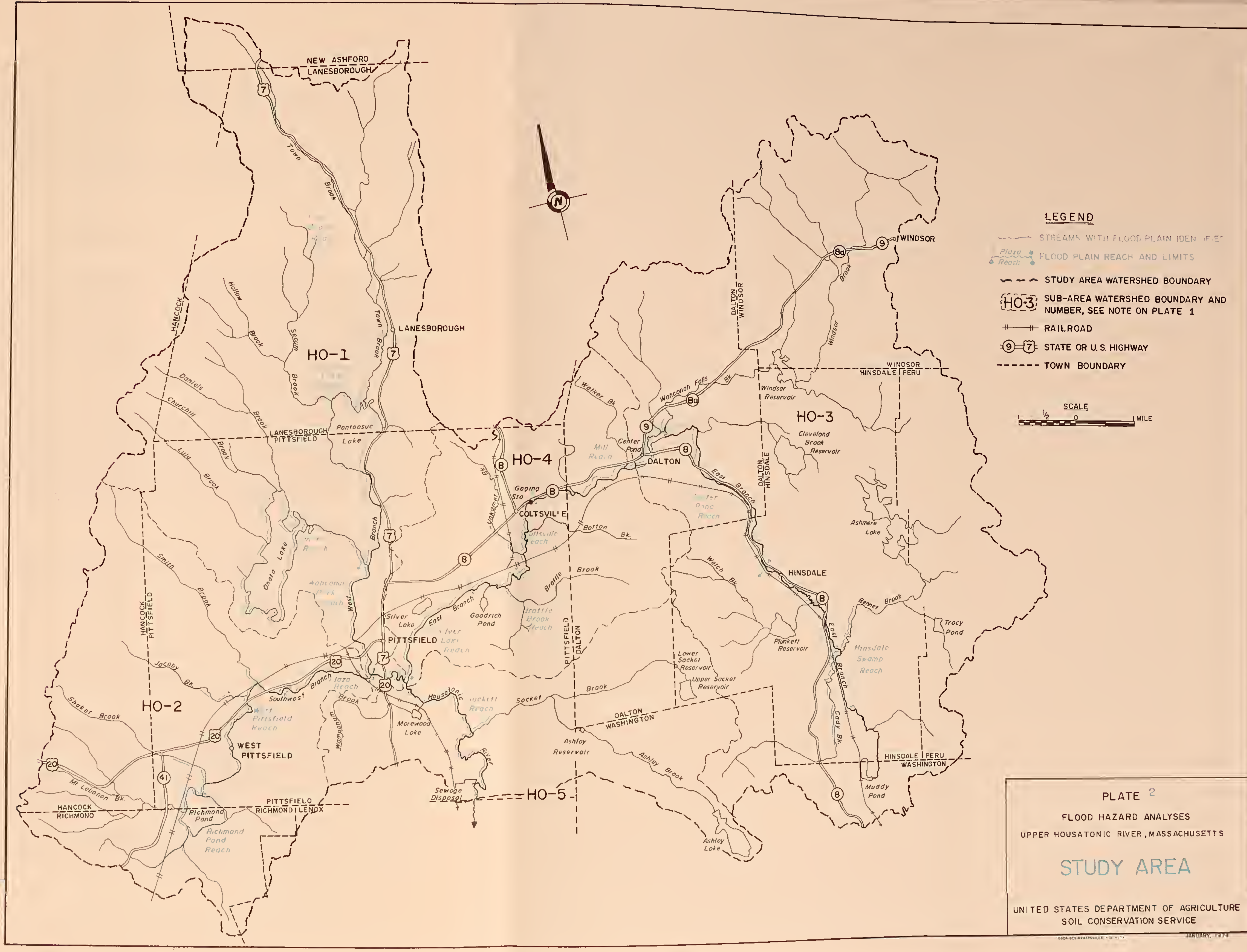


PLATE 2

FLOOD HAZARD ANALYSES

UPPER HOUSATONIC RIVER, MASSACHUSETTS

STUDY AREA

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

JANUARY, 1974

The flood plain vegetative cover in the open areas is generally tall grasses and brushy thickets. The wooded areas are thin stands, except east of the railroad crossing.

The major soil series in the flood plain are Limerick and Winooski, with minor areas of Muck. There are some areas of made land.

Housatonic River

Sackett Brook Reach -- This flood plain extends from the formation of the Housatonic River at the West and Southwest Branches confluence to the study area limit at the Pittsfield-Lenox boundary. The reach length is four miles, varying from 500 to 2000 feet in width, and at the 100-year flood elevations it consists of approximately 690 acres. The three stream crossings are South Street (U.S. Route 20), Pomeroy Avenue and Holmes Road. Just below the East Branch confluence the main service line to the Pittsfield Sewage Plant crosses the river by means of an inverted siphon.

The flood damage center is South Street and vicinity. This is the approximate limit of extensive development within this flood plain. The major flood damages would probably be incurred by residential properties. The flood plain south of Holmes Road is undeveloped, and enclosed by New Lenox Road on the east and Holmes Road-Penn Central Railroad on the west. The Pittsfield sewage disposal facilities are located at the lower study area limit.

Excepting the residential areas, the open areas of the flood plain are covered with tall herbaceous plants and shrub thickets, with the perimeter wooded.

The major soils within the flood plain are in the Limerick and Winooski series, with minor areas of the Suncook series.

HISTORY OF FLOODING

Within the past 50 years, the Upper Housatonic River Watershed has experienced numerous flood events. The most significant of these occurred in 1927, 1936, 1938, 1948-49, 1969, and 1973. While parts of Massachusetts experienced a severe flood in August 1955, resulting from Hurricane Diane, the Upper Housatonic River Watershed received only a portion of the record-breaking rainfall experienced by other areas.

The flood of September 1938 and the New Year Flood of 1948-1949 were the most severe and damaging floods to occur within the study area in recent

times. Tables 4, 5, and 6 contain data relative to these two floods. Table 4 summarizes the daily rainfall for a 7-day period encompassing the 1938 and 1948-49 floods as recorded at the Pittsfield Station. Table 5 is a summary of the annual peak discharges at the stream gaging station in Coltsville, for the period of 1936 to 1971, accompanied by a brief history of the gage. Table 6 lists selected historical flood elevations for the 1938 and 1948-49 flood events, collected from numerous sources, and these appear to be the most reasonable for the locations tabulated. Flood crest stages for the 1936 flood have been published by the Geological Survey, USDI, in Water-Supply Paper 798; The Floods of March 1936, Part 1, New England Rivers, and are not repeated in this report.

A brief description of these two floods and some of the available flood photographs follow.

Flood of September 1938

This flood was caused by four days of heavy rainfall climaxed by a hurricane on September 21. The rainfall gage at Pittsfield recorded 7.3 inches of rainfall for this storm. The USGS stream gaging station at Coltsville recorded the highest discharge of record on that date, and this discharge (6,400 cfs) remains the maximum ever recorded.

Damages and losses resulting from this flood were enormous. The flood was credited with claiming 136 lives throughout the state. In the City of Pittsfield, damages were reported to be in excess of $230,000, with over $30,000 for stream channel clean-up and improvement. The residential areas of Lakewood on the east side, and Zoar Avenue in West Pittsfield were severely damaged. Discharges on the Southwest Branch were adversely affected by the failure of two river dams and the destruction of five bridges.

New Year Flood of 1948-49

The New Year Flood of 1948-49 was the result of a three-day rainfall which began on December 29, and deposited amounts ranging from 5 to 12 inches over the study area. For the most part, snow cover was light and had little effect on the magnitude of flood discharges. The streams began to rise on December 30 and reached their peaks on December 31 in the study area. Secondary peaks occurred on January 6 as a result of additional rainfall. This flood failed to reach the 1936 or 1938 discharges recorded at the Coltsville Station primarily because of the distribution and varying depths of rainfall, the drawndown stage in several reservoirs, and the shallow depth of snow cover.

TABLE 4

HISTORICAL STORM RAINFALL

FLOOD HAZARD ANALYSES
UPPER HOUSATONIC RIVER

SEPTEMBER 1938 FLOOD 1/

Date	Rainfall (inches)	
September 11, 1938	0.0	
12, 1938	1.15	
13, 1938	0.0	
14, 1938	0.70	
15, 1938	0.15	
16, 1938	0.0	
17, 1938	0.05	
18, 1938	0.20	September 1938 Storm
19, 1938	2.50	
20, 1938	1.57	
21, 1938	3.00	
22. 1938	Trace	

NEW YEAR FLOOD 1948-1949 2/

Date	Rainfall (inches)	
December 23, 1948	0.11	
24, 1948	0.0	
25, 1948	0.01	
26, 1948	0.0	
27, 1948	0.0	
28, 1948	0.0	
29, 1948	0.49	New Year Storm 1948-1949
30, 1948	4.25	
31, 1948	3.20	
January 1, 1949	0.41	
2, 1949	0.15	
3, 1949	0.01	

1/ Weather Bureau, USDA - morning measurement; amount recorded is for the preceding 24 hours, Pittsfield.

2/ Weather Bureau, USDC - precipitation is for the 24-hour period, midnight to midnight, Pittsfield WB Airport.

Newell Street bridge over East Branch; September 1938 flood.

Looking westerly at the Lakewood section of Pittsfield along the East Branch, September 1938 flood.

Hubbard Avenue bridge over the East Branch, September 1938 flood.

Penn Central Railroad crossing over Shaker Brook, New Year flood of 1948-1949.

East Branch downstream of Dawes Avenue bridge, New Year flood of 1948-1949.

Pomeroy Avenue Pumping Station along East Branch, New Year flood of 1948-1949.

TABLE 5
ANNUAL PEAK DISCHARGES
EAST BRANCH HOUSATONIC RIVER at COLTSVILLE, MASSACHUSETTS
FLOOD HAZARD ANALYSES
UPPER HOUSATONIC RIVER

USGS Stream Gaging Station 011970 1/

LOCATION -- Lat 42°28'10", long 73°11'49", Berkshire County, on right bank 40 ft. downstream from Hubbard Avenue Bridge at Coltsville, 1.2 miles upstream from Unkamet Brook, and 2 miles northeast of Pittsfield.

DRAINAGE AREA -- 57.1 sq. mi.

PERIOD OF RECORD -- March 1936 to current year.

GAGE -- Water-stage recorder. Datum of gage is 993.49 ft. mean sea level.

AVERAGE DISCHARGE -- 35 years, 109 cfs (25.92 in./yr.), adjusted for diversion.

EXTREMES -- Period of record: Maximum discharge, 6,400 cfs Sept. 21, 1938 (gage height, 10.80 ft.), from rating curve extended above 2,300 cfs on basis of computation of peak flow over dam; minimum daily, 4.4 cfs Aug. 15, 1936. Maximum discharge since at least 1755, that of Sept. 21, 1938.

REMARKS -- Records good except for periods of no gage-height record, which are fair. Flow regulated by powerplants above station and, since 1949, by Cleveland Brook Reservoir (useable capacity, 214,000,000 cu. ft.) 5.4 miles upstream; regulation greater prior to 1955. Diversion above station from Cleveland Brook Reservoir for municipal supply of Pittsfield since May 1950.

Year	Discharge (cfs)	Date	Year	Dishcarge (cfs)	Date
1936	6,000	March 18	1954	1,870	Sept. 11
1937	1,910	May 15	1955	1,640	Aug. 19
1938	6,400	Sept. 21	1956	2,010	Oct. 16
1939	3,410	April 19	1957	1,120	Jan. 23
1940	1,380	April 12	1958	1,090	Dec. 21
1941	832	Sept. 1	1959	1,730	Jan. 22
1942	1,440	March 9	1960	1,920	Sept. 12
1943	1,740	Nov. 25	1961	998	April 23
1944	1,280	Nov. 9	1962	1,450	April 8
1945	1,970	July 22	1963	582	April 3
1946	1,190	March 9	1964	908	April 15
1947	1,730	April 6	1965	394	April 16
1948	1,970	March 22	1966	654	Dec. 26
1949	5,700	Dec. 31	1967	1,040	April 3
1950	1,070	April 5	1968	1,480	April 25
1951	3,280	Nov. 26	1969	3,710	April 23
1952	2,080	June 1	1970	1,060	Nov. 8
1953	1,630	March 24	1971	1,080	Aug. 28

1/ Geological Survey, USDI - 1971 Water Resources Data for Massachusetts; Summary of annual peak discharges taken from USGS Water Supply Papers.

TABLE 6
SELECTED HISTORICAL FLOOD ELEVATIONS [1/]
FLOOD HAZARD ANALYSES
UPPER HOUSATONIC RIVER, MASSACHUSETTS

LOCATION	PROFILE STATION	SEPTEMBER 1938 (Source)[2/]		NEW YEAR 1948-49 (Source)[2/]	
East Branch					
Mass. Route 8, Hinsdale	117+50	1431.6	(M)	1431.6	(C)
Main Street, Hinsdale	117+00	1428.6	(M)	1428.5	(C)
East Housatonic Street	310+50	1177.5	(M)	1178.2	(C)
Main Street, Dalton	408+00			1142.6	(C)
Center Pond Dam	408+50	1140.5	(M)	1140.5	(C)
Byron-Weston No. 2 Dam	416+90			1123.8	(C)
Pioneer Mill Dam	470+20			1048.4	(C)
Government Mill Dam	524+40	1015.6	(M)	1016.0	(C)
USGS Gage 011970	531+00	1004.3	(G)	1003.9	(G)
Footbridge, Lakewood	643+50	990.4	(M)	987.4	(P)
Newell Street	664+80	988.5	(M)	986.0	(P)
Lyman Street	695+80	983.2	(M)	984.5	(P)
Elm Street	715+80	981.4	(M)	981.6	(P)
Dawes Avenue	736+20	972.3	(M)	974.4	(C)
Pomeroy Avenue	751+50	970.2	(M)	971.0	(C)
West Branch					
Pontoosuc Lake Dam	530+00	1100.3	(P)	1099.5	(P)
Bel Air Dam	584+50	1036.4	(M)	1035.3	(P)
Mill Street	693+50	979.9	(M)	975.9	(P)
West Housatonic Street	705+50	978.7	(M)		
Onota Lake Dam	553+75	1080.3	(P)	1077.6	(P)
Southwest Branch					
Hungerford Street #3	571+50	1064.0	(M)		
Mass. Route 20	593+90	1038.0	(M)		
Hungerford Street #1	618+00	1019.2	(M)	1019.0	(P)
Mass. Route 20	625+50	1011.4	(M)		
Cadwell Road	669+70	977.3	(M)	980.1	(P)
Route 20 and Gale Avenue	681+25	976.3	(M)	978.5	(P)
Housatonic River					
South Street	741+80	970.2	(P)	970.7	(P)
Holmes Road	810+75	968.2	(P)	966.1	(C)
New Lenox Road	976+00	959.7	(M)	958.5	(C)

1/ Mean Sea Level (MSL) Datum, all elevations are upstream of the constrictions unless noted and do not necessarily represent present flood flow conditions.

2/ Agency source of data
(C) Corps of Engineers, US Army
(P) Pittsfield Department of Public Works
(M) Massachusetts Department of Public Works
(G) Geological Survey, USDI

The New Year Flood was the most costly, in terms of dollars, the study area has experienced to date. In Pittsfield, municipal damages were about $110,000 which included roads, bridges, pipelines, etc. Municipal damages in Dalton, Hinsdale and Lanesborough totaled nearly $25,000. Substantial damage was incurred by industries in Pittsfield and Dalton, with some industrial plants reporting three feet of water inside the plant. Dollar totals for residential damage and work-loss are not readily available, but would be staggering.

Damages also included the erosion and subsequent deposition of soil, the debris left by receding waters, and the alteration of stream courses. The Commonwealth of Massachusetts reportedly spent approximately two million dollars on a program to clean up the stream channels in the flooded areas following this storm.

PRESENT FLOOD PLAIN REGULATIONS

The Towns of Dalton, Hinsdale, Lanesborough and the City of Pittsfield have adopted zoning authorized by the Zoning Enabling Act, Chapter 40A of the Massachusetts General Laws. These communities, however, have not adopted "all encompassing" flood plain zoning ordinances for appropriate local land use control measures for their wetland and flood-prone areas. Provision is made in the Zoning Enabling Act specifically for ordinances which regulate the use of an area subject to seasonal or periodic flooding for the benefit of the occupants as well as to protect public health, safety and the general welfare.

The City of Pittsfield, in its Zoning Ordinance, dated February 16, 1973, establishes Flood Plain Districts. The text of Article 23-6 in this ordinance suggests that the city is very close to establishing Flood Plain Zoning Districts and may only be awaiting engineering data on which to base zoning.

The Town of Lanesborough, in its Zoning By-law dated 1965, recognizes the existence of flood plain areas. However, Section IV-C of this By-law does not zone the flood plain areas as such, nor are there provisions for rigorous regulation of flood plain areas. This 1965 Zoning By-law is in the process of being updated.

The Town of Hinsdale, in its Zoning By-laws dated May 1971, while recognizing the natural occurrence of floods, makes no reference to flood plains.

The Zoning By-law of the Town of Dalton reissued in April 1973 does not refer to either floods or flood plain areas.

Statewide regulations concerning wetlands and flood plains include the following:

Prior to the Acts of 1972, Chapter 131, Section 40 of the General Laws of Massachusetts (Hatch Act) as enacted in 1965, required filing notice, holding public hearings and imposing conditions for excavation and filling of inland wetlands. The Hatch Act authorized the Commissioner of Natural Resources, on a case by case basis, to impose conditions restricting the alteration of lands which he determines to be essential for proper flood control or for public or private water supply. This act was amended in February 1972 to include the protection of ground water.

Chapter 131 was further amended by Chapter 784, Acts of 1972, to replace the Hatch Act with a new Section 40 (Wetlands Protection Act). This new law, which went into effect October 1972, gives the initial responsibility of issuing permits to the town conservation commissions and strengthens the procedural steps. The town has to determine that the area, on which notice of intention to remove, fill, dredge or alter, "is significant to public or private water supply, to the ground water supply, to flood control, to storm damage prevention, to prevention of pollution, to protection of land containing shellfish, or to the protection of fisheries." After a public hearing, the town by written order, can impose such conditions as will contribute to the protection of these interests. The Commissioner of Natural Resources may also make a determination after the town's order at the request of an aggrieved person, an abutting land owner, any ten residents of the town, or at his own request. Conditions imposed by the Department of Natural Resources supersede the prior order of the town, but can be appealed.

Section 4, of this new Wetlands Protection Act authorized and directed the Department of Natural Resources to map the Commonwealth for the purpose of delineation of wetlands.

Chapter 131, Section 40A of the General Laws of Massachusetts, as amended by Chapter 782 of the Acts of 1972, gives the Commissioner of Natural Resources the authority to protect inland wetlands and flood plains by establishing encroachment lines "for the purposes of preserving and promoting the public safety, private property, wildlife, fisheries, water resources, flood plain areas and agriculture." The Commissioner may adopt orders regulating, restricting or prohibiting the altering or polluting of inland wetlands by designating lines with which no obstruction or encroachment would be permitted without prior approval. These restrictions require notifications to each assessed land owner affected, public hearings, and approval of the town. Due to the magnitude of work required for the preparation and implementation of this law, it has not been implemented in the Housatonic River Basin to date.

POTENTIAL FLOODS

Present Watershed Conditions

A flood having an average frequency of occurrence in the order of once in 100 years (a one percent chance of being equalled or exceeded in any given year) was selected to best reflect the present flooding problems. However, floods larger than the 100-year flood can, and have, occurred on many streams. Severe as the maximum known flood may have been on any given stream, eventually, a larger flood can and probably will occur. To show the effects of an extreme flood in the watershed, the Rare flood (approximate 500-year frequency) was developed and used to illustrate this condition. The effects of smaller floods, which would be more likely to occur, are shown by the 10-year flood. This flood would have a ten percent chance of being equalled or exceeded in any given year.

The probability and magnitude of flooding is based on: the soil types, present land use, and cover conditions of the watershed; and an analysis of rainfall and runoff characteristics and the streams' flood history.

Flood stages presented in this report are based on the assumption that road, railroad, and dam embankments will not fail before the maximum flood stages are reached. Unusual trash blockages or ice jams are not considered in the calculations.

Increased urbanization, loss of natural floodwater storage and/or flood plain encroachment will tend to increase the flood stages, as discussed later in this section.

Computations for the potential floods assumed the pre-storm elevation of the pool area for the major reservoirs as:

Reservoir	Assumed Pool Elevations (MSL)
Ashmere Lake	1578.0
Plunkett Reservoir	1501.0
Windsor Reservoir	1447.0
Cleveland Brook Reservoir	1429.0
Center Pond	1136.2
Richmond Pond	1121.4
Pontoosuc Lake	1097.1
Onota Lake	1078.9

The magnitude in inches of rainfall of the flood-producing storms developed for the study area are:

Event	Storm Rainfall & Duration
10-year frequency	4.25 inches in 24 hrs.
100-year frequency	6.55 inches in 24 hrs.
Rare flood	8.25 inches in 24 hrs.

Actual storms will usually vary widely in precipitation and watershed conditions prior to the storm, but it is standard practice to assume that evaluation storms will occur with uniform rainfall and an average watershed moisture condition. By assuming a distribution where 45% of the rainfall will occur in one hour and 71% in six hours, the synthesized storms will produce floods of the specified frequency on one, as well as, 100 square mile watersheds in this study area.

The areas along the major streams and storage areas affected by the 100-year flood are shown on Plates 5 through 10; depths of flooding for the 10-year, 100-year and Rare floods can be estimated from the flood profiles shown on Plates 11, 12, and 13. The difference in flood elevations of the 10-year and Rare floods from the 100-year flood can be used to estimate their respective extent of flooding relative to the 100-year flood plain. The accuracy of such estimates would vary with one's experience in such judgements, familarity with the topography in question, and the extent of field inspection. The most accurate method of delineating these additional specific flood plains would be the obtaining of additional survey data and using their respective flood elevations from the profile.

Flood limits may vary on the ground from that shown in the swampy and wooded areas on the Flood Hazard Areas maps. Therefore, flood profile elevations should be used in all cases where there is a discrepancy with the flood lines on the topographic maps.

Information on elevations and flows for the potential floods under present conditions for selected stream crossings are listed in Tables 7, 8, and 9; for selected river dams and reservoirs in Table 10. These tables provide basic information for state and local officials to evaluate present and proposed developments in the flood plain areas.

The following photographs show the relative depths of flooding from the indicated potential floods at selected locations within the study area. The depths shown correspond to the flood profiles.

Hinsdale -- Looking easterly at the Maple Street Bridge over the East Branch.

Dalton -- Looking westerly at the Main Street Bridge over the East Branch.

Pittsfield -- Looking northeasterly along East Street in the vicinity of Silver Lake and the East Branch, flood of September 1938.

Pittsfield -- Looking northeasterly along East Street in the vicinity of Silver Lake and the East Branch.

Pittsfield -- Looking north along the Lyman Street Bridge over the East Branch.

Pittsfield -- Looking southeasterly along Pomeroy Avenue. Pomeroy Avenue Bridge over the Housatonic River is in background.

Pittsfield -- Looking westerly along the Cadwell Road Bridge over the Southwest Branch and Zoar Avenue, New Year flood of 1948-1949.

Pittsfield -- Looking westerly at the Cadwell Road Bridge over the Southwest Branch.

Pittsfield -- Pontoosuc Lake Dam, with U.S. Route 7 in background.

Pittsfield -- Looking northwesterly along the Wahconah Street Bridge over the West Branch.

FLOOD HAZARD ANALYSES
UPPER HOUSATONIC RIVER
MASSACHUSETTS

INFORMATION FOR SELECTED STREAM CROSSINGS
EAST BRANCH HOUSATONIC RIVER

TABLE 7
STREAM CROSSINGS
EAST BRANCH

STREAM CROSSING	PROFILE STATION	DRAINAGE AREA	STREAM CROSSING DATA						POTENTIAL FLOOD DATA 4/					
			TYPE	BRIDGE 2/ AREA	ELEVATION (feet) 3/				DISCHARGE (CFS) 5/			ELEVATION (feet) 6/		
					STREAM BOTTOM	TOP of OPENING	ROADWAY at CROSSING	LOW POINT on ROADWAY	10-YEAR	100-YEAR	RARE	10-YEAR	100-YEAR	RARE
	feet	sq. mi.		sq. ft.										
EAST BRANCH HOUSATONIC RIVER														
Mass. Route 8, Hinsdale	117+50	18.7	Concrete Girder	530	1420.3	1432.2	1436.4	1430.5	1435	3330	4915	1429.4	1433.5	1435.0
Maple Street	171+50	23.7	Steel Girder	310	1420.9	1428.5	1432.5	1431.8	1685	3745	5475	1428.7	1433.2	1434.4
Main Street, Hinsdale	177+00	23.8	Steel Truss	485	1416.5	1428.8	1433.7	1433.6	1685	3750	5475	1425.6	1428.3	1432.0
Mass. Route 8, Hinsdale	198+50	24.2	Concrete Slab	440	1360.6	1373.9	1384.2	1381.2	1720	3800	5550	1367.1	1370.5	1373.1
Old Dalton Road	219+50	25.5	Steel Girder	375	1333.4	1342.9	1343.1	1342.8	1760	3875	5650	1340.5	1343.6	1344.6
Mass. Route 8, Dalton	259+50	26.3	Concrete Slab	260	1284.1	1289.7	1294.3	1293.3	1780	3925	5715	1288.2	1295.5	1296.9
East Housatonic Street	310+50	27.2	Concrete Slab	595	1171.7	1181.8	1185.6	1184.3	1790	3950	5750	1176.3	1179.2	1181.0
Mass. Route 8, Dalton	314+50	27.2	Concrete Slab	465	1167.3	1179.3	1181.9	1179.4	1790	3950	5750	1173.5	1176.4	1178.4
Windsor Road	335+40	27.7	Steel Girder	280	1143.2	1151.0	1154.0	1154.0	1820	4000	5820	1151.5	1154.8	1155.6
Orchard Road	365+60	30.5	Steel Girder	530	1135.4	1146.1	1150.1	1149.4	1925	4265	6230	1141.4	1146.8	1150.3
Main Street, Route 8, Dalton	408+00	52.6	Concrete Slab	1195	1124.6	1140.6	1145.3	1144.2	3475	8155	12285	1140.9	1145.2	1147.3
South Street	490+90	56.8	Steel Girder	1120	1014.9	1028.8	1032.1	1031.9	3600	8480	12850	1024.1	1028.7	1034.4
Hubbard Avenue	531+30	57.1	Steel Girder	700	993.4	1003.3	1006.4	1005.7	3650	8580	13000	999.9	1002.5	1008.7
Penn Central Railroad	587+20	62.0	Steel Girder	1600	974.5	996.6	1006.7	1006.6	3960	9170	13800	988.2	992.4	996.3
East Street	600+80	62.8	Steel Girder	1490	974.4	991.9	993.9	990.9	3960	9170	13800	985.4	991.8	995.3
Newell Street	664+80	67.6	Steel Girder	1050	970.3	985.7	989.5	985.5	4090	8975	13400	984.0	990.5	994.8
Lyman Street	695+80	69.0	Steel Girder	645	969.7	981.2	985.7	983.2	4090	8975	13400	982.6	989.2	994.1
Elm Street	715+80	69.6	Concrete Arch	800	968.9	987.1	990.7	990.7	4090	8975	13400	980.3	987.0	993.1
Dawes Avenue	736+20	70.0	Steel Girder	615	960.3	968.7	977.9	977.6	4135	9035	13460	973.3	980.0	982.1
Pomeroy Avenue	751+50	70.1	Steel Girder	735	957.8	970.6	974.4	969.6	4135	9035	13460	969.6	974.5	977.3
WAHCONAH FALLS BROOK														
North Street, Route 9, Dalton	--	19.0	Steel Girder	475	1144.8	1153.2	1156.6	1155.8	1800	4660	7035	1150.2	1151.7	1156.7

1/ Information developed for planning use only, not to be used for final design or construction.
2/ Effective hydraulic flow area of structure opening.
3/ Mean Sea Level Datum (MSL)
4/ Floods that can occur under present watershed and flood plain conditions, see Text.
5/ CFS -- cubic feet per second
6/ MSL: Elevations computed at the upstream side of the stream crossings.

SCS-HYATTSVILLE, MD. 1974

FLOOD HAZARD ANALYSES
UPPER HOUSATONIC RIVER
MASSACHUSETTS

INFORMATION FOR SELECTED STREAM CROSSINGS
WEST BRANCH HOUSATONIC RIVER

TABLE 8
STREAM CROSSINGS
WEST BRANCH

STREAM CROSSING	PROFILE STATION	DRAINAGE AREA	STREAM CROSSING DATA: TYPE	BRIDGE AREA 2/	ELEVATION (feet) 3/: STREAM BOTTOM	TOP of OPENING	ROADWAY at CROSSING	LOW POINT on ROADWAY	POTENTIAL FLOOD DATA 4/: DISCHARGE (CFS) 5/: 10-YEAR	100-YEAR	RARE	ELEVATION (feet) 6/: 10-YEAR	100-YEAR	RARE
	feet	sq. mi.		sq. ft.										
WEST BRANCH HOUSATONIC														
Pontoosuc Avenue	607+00	22.8	Concrete Slab W/Building Attached	115	994.4	1000.1	1004.1	1003.9	760	1990	3325	1001.3	1005.2	1005.8
Wahconah Street	615+40	22.9	Concrete Slab	215	991.0	996.5	998.7	997.9	760	2000	3340	997.8	1000.8	1002.7
Linden Street	653+50	34.7	Steel Truss	240	986.7	991.5	994.8	993.2	1100	2545	4070	994.3	997.7	999.8
Columbus Avenue	668+90	35.3	Concrete Slab	355	984.9	995.0	998.5	997.1	1130	2565	4095	993.1	996.5	998.7
West Street	680+40	35.5	Concrete Arch	180	984.1	993.2	995.0	991.7	1130	2570	4105	992.3	994.9	996.6
Mill Street	693+50	35.7	Concrete Arch	405	968.4	980.0	982.8	982.2	1130	2580	4115	974.1	977.3	980.1
West Housatonic Street	705+50	35.8	Steel Girder	705	966.1	977.6	981.3	979.8	1130	2585	4120	972.1	975.0	978.0
ONOTA BROOK														
Lakeway Drive	547+80	10.3	Concrete Slab	210	1071.6	1080.8	1083.9	1082.8	300	480	655	1079.8	1080.9	1081.6
Elmvale Road	607+00	11.0	Concrete Slab	60	995.3	999.6	1001.6	1001.4	430	930	1325	1001.5	1002.3	1002.7
TOWN BROOK 7/														
(Near Scotts Road Bridge)	230+50	4.5	Channel Section	-	-	-	-	-	1075	2500	3700	6.5	9.4	11.0
Williamstown Road (U.S. Route 7)	294+50	7.3	Concrete Slab	-	-	-	-	-	1620	3870	5700	8,2	12.9	14.4
(Near Drive-in Theater)	345+00	9.2	Channel Section	-	-	-	-	-	1690	4100	5950	5.1	6.0	6.5

1/ Information developed for planning use only, not to be used for final design or construction.
2/ Effective hydraulic flow area of structure opening.
3/ Mean Sea Level Datun (MSL)
4/ Floods that can occur under present watershed and flood plain conditions, see Text.
5/ CFS -- cubic feet per second
6/ MSL: Elevation computed at the upstream side of the stream crossings.
7/ Stage -- discharge data only

USDA-SCS-HYATTSVILLE, MD. 1974

FLOOD HAZARD ANALYSES
UPPER HOUSATONIC RIVER
MASSACHUSETTS

INFORMATION FOR SELECTED STREAM CROSSINGS SOUTHWEST BRANCH HOUSATONIC RIVER HOUSATONIC RIVER

TABLE 9
STREAM CROSSINGS
SOUTHWEST BRANCH
HOUSATONIC RIVER

STREAM CROSSING	PROFILE STATION	DRAINAGE AREA	STREAM CROSSING DATA						POTENTIAL FLOOD DATA 4/					
			TYPE	BRIDGE 2/ AREA	ELEVATION (feet) 3/				DISCHARGE (CFS) 5/			ELEVATION (feet) 6/		
	feet	sq. mi.		sq. ft.	STREAM BOTTOM	TOP of OPENING	ROADWAY at CROSSING	LOW POINT on ROADWAY	10-YEAR	100-YEAR	RARE	10-YEAR	100-YEAR	RARE
SOUTHWEST BRANCH HOUSATONIC														
Cloverdale Street	520+10	10.7	Steel Girder	55	1100.5	1105.1	1108.3	1108.3	450	1195	2340	1107.2	1109.7	1111.8
Melbourne Road	549+60	11.1	Steel Girder	260	1094.0	1105.2	1108.3	1108.3	465	1200	2345	1099.6	1102.6	1105.6
West Housatonic Street (U.S. Route 20)	593+90	12.4	Concrete Slab	250	1032.1	1041.1	1045.0	1044.5	745	1635	2665	1036.6	1039.1	1043.5
West Housatonic Street (U.S. Route 20)	625+50	20.1	Concrete Slab	145	1002.5	1007.8	1012.2	1010.6	1515	2830	4810	1012.2	1013.9	1015.2
Cadwell Road	669+70	21.6	Steel Girder	185	969.9	977.0	979.5	979.0	1565	2890	4900	978.6	986.9	990.6
Barker Road	696+70	22.7	Steel Girder	560	965.0	980.7	983.3	983.2	1665	3010	5100	976.6	986.7	990.2
Penn Central Railroad	711+50	22.9	Stone-Brick Arch	130	963.8	973.8	992.6	985.0	1745	3100	5250	976.5	986.7	990.0
SHAKER BROOK														
Penn Central Railroad 7/	466+60	2.7	3 Culvert Combination 2-4.0'ID, 1-5.0'ID	32	1103.2	1109.2	1113.7	1113.7	165	410	1425	1111.0	1113.8	1114.4
HOUSATONIC RIVER														
South Street (U.S. Routes 20 & 7)	741+80	59.1	Steel Girder	515	959.0	971.0	975.6	973.3	2800	5300	8300	969.8	974.6	977.2
Pomeroy Avenue	803+30	132.2	Steel Girder	1130	955.1	968.3	973.5	966.8	5200	12000	18500	967.2	972.2	975.4
Holmes Road	810+75	132.5	Steel Girder	1125	954.3	969.8	976.2	971.8	5200	12000	18500	966.0	970.8	974.7
New Lenox Road	976+00	146.3	Steel Girder	1600	941.8	959.5	966.0	960.3	5500	12500	19000	955.6	960.6	963.6

1/ Information developed for planning use only, not to be used for final design or construction.
2/ Effective hydraulic flow area of structure opening.
3/ Mean Sea Level Datum (MSL)
4/ Floods that can occur under present watershed and flood plain conditions, see Text.
5/ CFS -- cubic feet per second
6/ MSL: Elevations computed at the upstream side of the stream crossings.
7/ Stream bottom elevation is silt level in lower culverts.

USDA-SCS-HYATTSVILLE, MD. 1974

FLOOD HAZARD ANALYSES
UPPER HOUSATONIC RIVER
MASSACHUSETTS

INFORMATION FOR SELECTED DAMS

TABLE 10
DAMS

DAM	PROFILE STATION	DRAINAGE AREA	DAM DATA							POTENTIAL FLOOD DATA 4/					
			TYPE 2/	HEIGHT	ELEVATION 3/		CREST LENGTH	NORMAL POOL AREA	PRESENT CAPACITY 7/	DISCHARGE (CFS) 5/			ELEVATION (feet) 6/		
					TOP of DAM	CREST				10-YEAR	100-YEAR	RARE	10-YEAR	100-YEAR	RARE
	feet	sq. mi.		feet	feet	feet	feet	acres	CFS						
MILL DAMS															
East Branch Housatonic															
Grist Mill, Hinsdale	182+00	23.8	Stone Weir with Planking	11	1424.7	1421.4	61	3	1800	1685	3750	5475	1424.6	1426.2	1427.4
Byron Weston No. 2, Dalton	416+90	52.6	Stone Masonry Weir	23	1125.2	1116.6	60	1	5000	3475	8155	12285	1123.4	1128.9	1132.0
Old Berkshire Mill	449+90	55.9	Concrete Ogee Weir	19	1078.0	1070.7	116	2	7800	3530	8365	12620	1075.1	1078.4	1080.8
Pioneer Mill	470+20	56.1	Stone with Masonry Weir	13	1049.5	1044.5	161	3	6500	3530	8365	12620	1047.9	1050.5	1052.3
Government Mill	524+40	57.1	Stone Weir	14	1016.1	1010.0	142	3	7500	3650	8580	13000	1013.8	1017.3	1019.5
West Branch Housatonic															
Bel Air	584+70	22.7	Earthfill with stone Masonry Weir	26	1037.3	1033.1	57	3	1600	750	1975	3300	1035.7	1037.6	1039.2
RESERVOIRS															
Ashmere Lake 8/	-	4.0	Earthfill w/Stone Weir, Gated Control	35	1583.0	1580.0	75	253	1000	130	170	250	1578.7	1579.7	1580.5
Plunkett 8/	-	2.7	Earthfill with Concrete Ogee Weir	30	1506.2	1501.0	40	71	1900	205	660	1115	1502.3	1503.7	1504.8
Cleveland Brook 8/	-	1.4	Earthfill with Concrete Weir	71	1434.0	1429.0	80	144	3000	55	200	340	1429.4	1429.8	1430.1
Windsor 8/	-	14.7	Stone Masonry Arch and Weir	50	1453.0	1447.0	70	72	3000	1520	4100	6225	1451.0	1454.5	1457.2
Center Pond	409+20	52.6	Stone Masonry Weir	18	1144.1	1136.2	110	25	8100	3475	8155	12285	1140.6	1144.4	1147.6
Pontoosuc Lake	529+70	21.6	Earthfill Stone-Concrete Weir	19	1101.1	1097.1	80	482	2200	725	1925	3240	1099.2	1100.8	1102.5
Onota Lake	553+80	10.3	Earthfill Stone-Concrete Weir	15	1081.4	1078.9	38	619	600	300	480	655	1079.8	1080.9	1081.6
Richmond Pond	469+80	7.5	Earthfill with 2-Concrete Weirs	12	1126.9	1121.4	28 Main Weir	229	2200	285	870	1480	1123.1	1124.6	1125.6

1/ Information developed for planning use only, not to be used for final design or construction.
2/ General dam and major spillway construction type.
3/ Mean Sea Level Datum (MSL)
4/ Floods that can occur under present watershed and flood plain conditions, see Text.
5/ CFS -- cubic feet per second.
6/ MSL: Elevations computed at the upstream side of the dam.
7/ Present capacity computed at elevation of top of dam.
8/ Elevations assumed MSL, based on USGS Quadrangle water level elevations.

USDA-SCS-HYATTSVILLE, MD. 1974

Increased Urbanization of Watershed

Urbanization in the Upper Housatonic River study area, particularly in Pittsfield and vicinity, has and will continue to press for development and use of flood plain lands, as well as upland areas.

The development of all future urban areas should be approached cautiously with a good understanding of the effects that development will have on stream flow, water quality and quantity, erosion and sedimentation, flooding, conservation, wildlife and ecology related aspects. Since some increase in residential, commercial, and industrial urbanization is inevitable, the detrimental effects often associated with such developments should be minimized.

The continual process of clearing land for urban uses removes natural soil cover and intensifies both erosion and the amount and rate of runoff from the land. The eroding soil finds its way into streams, wetlands and reservoirs, thus reducing their natural storage capacity.

The impact of urbanization on the small headwater tributaries may change the natural stream regimen, resulting in entrenchment or incision. The increase in storm drains and impervious surfaces causes an increase in direct runoff as infiltration and ground water recharge are reduced. The time required for runoff to concentrate into streams is diminished as a result of the land use changes, and thus sharp increases in magnitude of peak discharges are realized.

In studying the effects of urbanization in the Upper Housatonic River study area, a potential for a significant increase in the volume of direct runoff and the magnitude of peak discharges was noted. An increase in urbanization of 10% was selected as an arbitrary condition to analyze, raising the total urban land use from 11% to 21% of the study area. This increase in urbanization was uniformly distributed through the upland in the study area. No changes were assumed in the present use of the flood plain. The following table illustrates the percent increases in direct runoff and peak discharges, and increased flood stages that would be associated with the 10-year and 100-year frequency storms at selected locations under this condition, compared to present watershed conditions.

Location	Profile Station	% Increase Direct Runoff		% Increase Peak Discharge		Increased Stage-Feet	
		10-yr	100-yr	10-yr	100-yr	10-yr	100-yr
Maple St., Hinsdale	171+50	8.0	5.0	10.0	5.5	1.3	0.4
Main Street, Dalton	408+00	8.0	5.0	9.0	5.5	0.1	0.5
Coltsville, Pittsfield	550+00	7.5	5.0	8.5	5.0	0.2	0.2
Elm Street, Pittsfield	715+80	7.0	5.0	8.0	5.5	1.3	2.5
Pontoosuc Lake	529+70	5.5	3.5	7.0	4.0	0.1	0.1
West St., Pittsfield	680+40	5.5	3.0	5.0	4.0	0.1	0.1
Penn Central Railroad Southwest Branch	711+50	4.0	3.0	3.0	3.5	0.4	0.4
South St., Pittsfield	741+80	5.0	3.0	3.0	2.0	0.2	0.2
Holmes Road, Pittsfield	810+75	4.0	3.0	4.5	3.5	0.5	0.2

Urbanization in general, and not just that confined to the development within flood plains, can have a detrimental effect on an existing potential flood problem. However, these detrimental effects can be minimized by the wise use of regulatory powers and a good knowledge and respect for our natural resources. Regulation, supported by soil survey interpretations and land treatment measures, can be used to control runoff, erosion and sedimentation.

The combined effects of urbanization in the study area, flood plain encroachment, and channel improvement of rivers and their tributaries would produce a variety of changes in flood storage and peak discharges. All three processes increase peak discharges, thereby increasing downstream flood stages. However, the effects of channel improvement on flood stages as compared to urbanization and encroachment could be beneficial in some areas. Therefore, the effects on flooding due to channel work and encroachment are discussed separately in the following sections.

Effects of Channel Improvement

Channel improvement as discussed in this section will relate only to the major hydraulic improvement of a channel by design. Generally, channel work designed as the sole structural measure to alleviate a flooding problem has a local beneficial effect, but could cause detrimental effects downstream. It was in this context that channel improvement was studied in the Pittsfield area as it might relate to a potential 100-year flood.

For the purpose of this study, it was necessary to assume a design channel for each location selected. In each case, the theoretical channel was proportioned to minimize construction, while enlarging the flow capacity of the existing channel.

The assumption was made that stream crossings presently restricting flood flows would remain unchanged.

The first improvement was located on the East Branch in the vicinity of Coltsville. The upper portion of the channel improvement was located between East Street upstream (north) to a point opposite the K-Mart. The lower portion of the channel improvement extended from East Street downstream (west) to the natural channel near the footbridge east of Newell Street.

The results of this study indicate that flood stages for the 100-year flood could be decreased within the upper reach north of the Penn Central Railroad, but would increase from East Street downstream. Actually, the peak discharges would increase for the 100-year flood by 5% at East Street and by 25% at the footbridge under this condition. This is a direct result of the accelerated flows created by the new channel and the loss of natural flood storage of Brattle Brook swamp. While reducing the 100-year flood stage by about 1 foot in the vicinity of the Drive-In theater in Coltsville,

an increase in flood stage of approximately 3 feet at Lyman Street could be expected.

The second location selected was on the Southwest Branch. The channel improvement was located between the Penn Central Railroad crossing and upstream of Cadwell Road (within the Plaza reach).

The results of studying this change show the Penn Central Railroad crossing as still being the restriction, and due to increased peak discharges the flood stage increased approximately 2 feet upstream of the railroad. The average velocity through this improved reach increased such that the peak discharge of the Southwest Branch at the confluence with the West Branch was timed nearer the peak discharge time of the West Branch. These increased discharges are cumulative in their effect on discharges downstream on the Housatonic River.

Because of the "fan-like" pattern of the study area watershed, the timing of the peak discharges in the Pittsfield vicinity of the three branches is especially significant. Of the channel improvements theorized in this study, or any combination of this work, the peak discharges on the Housatonic River (at or below the East Branch confluence and within the study area) will be increased for the potential 100-year flood, when compared to present conditions. Assuming the present constrictions remain, the potential flood stages on the Housatonic River would increase.

Effects of Flood Plain Encroachment

The most common form of flood plain encroachment is the filling of wetlands, swamps and floodways for development. The result of such encroachment is the loss of natural floodwater storage and/or the reduction in size of floodways. In both cases, increased peak discharges and flood stages during periods of flooding will most likely result.

The large number of natural storage areas within the study area precludes an in depth study of the effect on flood flows that each would have if filling and development took place. However, with the present limited floodwater retarding capability of the study area, excluding natural storage, careful consideration should be given to plans which would further reduce the capability to temporarily store floodwater.

The filling of flood plain lands and subsequent development reduce the width of the original floodway. A reduction in floodway width causes an increase in flood stage for the same discharge. Plate 3 illustrates the possible effect of reducing the floodway width by theoretical encroachment. An actual valley cross section on the East Branch in Coltsville is used for this example. The effects of increased discharges downstream due to loss in floodwater storage are not reflected in the tabulated data.

Effects of Reservoir Management

In order to create a long-range solution to flooding problems, it is essential to have the cooperation of all the communities in the watershed. An opportunity exists within the study area for a reservoir management program which requires such cooperation. The management or regulation of certain reservoirs to reduce peak flood discharges and resulting damages could be an integral part of the overall flood protection plan, complimenting local protection projects, floodwater retarding structures and protection of wetlands and flood plains of the study area.

The basic element in such a reservoir management program is providing additional storage for floodwaters by lowering the stage in existing reservoirs. The New Year Flood of 1948-1949 serves as an example of the benefits of such a program. The water surface in Onota and Pontoosuc Lakes was substantially lower than normal at the time of the storm. The additional storage provided by these reservoirs for storm runoff was instrumental in reducing peak flood discharges downstream on the West Branch and also at points farther downstream on the Housatonic River.

For the purpose of determining effects in this study Ashmere Lake, Plunkett Reservoir, Pontoosuc Lake, Onota Lake and Richmond Pond were selected for regulation or management. Water supply reservoirs were exempted.

Prior to flood routing with a reservoir management program in effect, elevations of the pool areas in the affected reservoirs were assumed to have been drawn down as shown in the following table. The increased floodwater storage available below the normal spillway elevation is given in acre-feet.

Reservoir	Pool Elevations (MSL)	Drawdown (FT)	Increased Storage (AC FT)
Ashmere Lake	1575.0	3.0	500
Plunkett Reservoir	1498.0	3.0	375
Richmond Pond	1118.4	3.0	600
Pontoosuc Lake	1094.0	3.1	1400
Onota Lake	1074.0	4.9	3000

The resulting peak discharges and flood stages under the reservoir management program, compared to those with present conditions, were reduced at most locations for the 10-year, 100-year and Rare floods. The West Branch experienced the greatest percent reduction in peak discharges (stage reductions of 0.5 to 1.4 feet), while the "Plaza area" west of the railroad crossing on the

CROSS SECTION & LOCATION	THEORETICAL ENCROACHMENT	EFFECTIVE FLOODWAY WIDTH	ADDITIONAL FLOOD STAGE
20V2	(Present Conditions)	1140′	0.0′
on East Branch Housatonic River in Coltsville		750′	0.5′
		600′	1.0′
		415′	2.0′

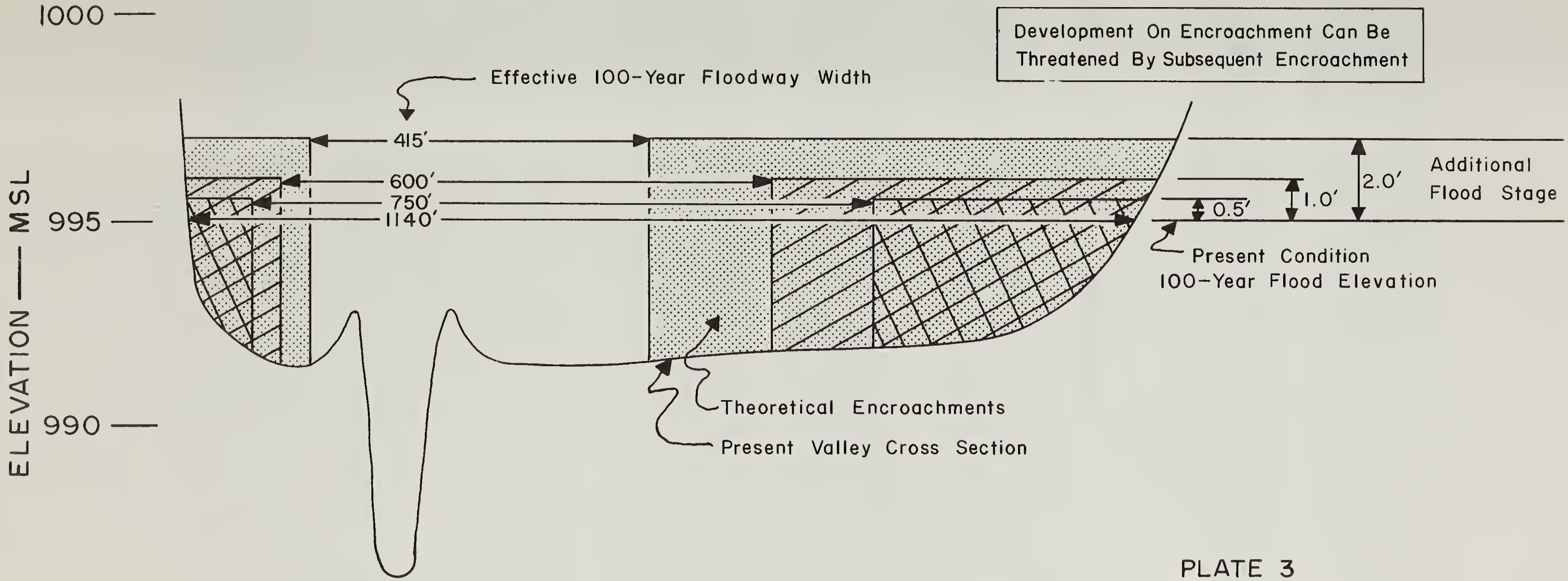


PLATE 3

FLOODWAY-DEPTH-WIDTH RELATIONSHIPS

FLOOD HAZARD ANALYSES
UPPER HOUSATONIC RIVER
MASSACHUSETTS

USDA-SCS-HYATTSVILLE, MD. 1974

JAN. 1974

Southwest Branch experienced a stage reduction of 1½ feet for the 100-year flood. Generally, the East Branch responded with stage reductions of ½ foot or less, but the combined effect downstream of the East Branch confluence yielded stage reductions of about 1 foot at Holmes Road and 1½ feet at New Lenox Road for the 100-year flood.

The results of this brief study of reservoir management indicates that the potential for reducing peak flood discharges and flood stages by such a program exists and should be considered as an alternative measure for protection.

ALTERNATIVES FOR FLOOD PLAIN MANAGEMENT

Flood damages may be minimized by careful planning and proper flood plain management. Flood plain management programs should contain regulatory and corrective measures which provide for the needs of man and nature.

Regulatory measures do not prevent flooding, but instead reduce the threat of damage or loss of life from floods by discouraging development on flood plains. Regulatory measures include flood plain regulations, development policies, land use restrictions, greenbelts or open space, and flood insurance. Tax adjustments and warning signs are related measures.

Corrective measures, while they do not eliminate flooding, can reduce the extent of flooding and resulting damages. These corrective measures are usually physical measures and can include land treatment, floodwater retarding structures, stream improvements, levees or floodwalls, existing reservoir management programs, flood proofing of structures, flood plain reclamation, and flood watch and warning systems.

A report entitled "Regulation of Flood Hazard Areas to Reduce Flood Losses" published in 1971, by the United States Water Resources Council contains useful information on these techniques for managing flood hazard areas. The report includes general draft statutes for flood hazard ordinances and regulations, and discusses specific legal considerations. The two volume report can be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, at a cost of $2.50 and $2.00 respectively. A reference copy is available at the Massachusetts Water Resources Commission and at each local Soil Conservation Service office.

Some techniques or alternatives for minimizing the risk of flooding are discussed in the following sections.

Regulatory Measures

Various flood plain management alternatives which are non-structurally oriented may be considered to reduce future floodwater damages. These include:

Encroachment Lines -- Encroachment lines are the lateral boundaries of a designated floodway. They are two definitely established lines, one on each side of the stream, and between these lines no construction or filling should be permitted which would impede the flood flow.

Zoning -- Zoning is a legal tool that may be used to implement and enforce the details of the flood plain management program, preserve property values and achieve the most appropriate and beneficial use of available land. Zoning can regulate the use of land and degree of development in flood hazard areas. Effective zoning requires enforcement of the zoning by-laws, which in turn depends upon a by-law that is clear, concise and thorough.

Subdivision Regulations -- Subdivision regulations can be used by town governments to specify the manner in which land may be subdivided within the entire area under their jurisdiction. Regulations may state the required width of streets, requirements for curbs and gutters, size of lots, percentage of open space, size of floodways and other points pertinent to the welfare of the community.

In reference to flood hazard areas, subdivision regulations may:

(1) Require location of flood-prone areas to be shown on the plat map.

(2) Require placement of streets and public utilities above a selected flood elevation.

(3) Require installation of adequate drainage facilities.

(4) Prohibit encroachment in floodway or flood hazard areas.

(5) Provide safe building elevations on lots above selected flood heights by means of fill or open structural support.

Building Codes -- The primary purpose of building codes is to set up minimum standards for controlling the design, construction and quality of materials used in buildings and structures within a given area so that life, health, property, and public welfare are safeguarded. Since it may not be practical to prevent building in all areas subject to flooding, building codes can be used to minimize structural and subsequent damages resulting from inundation. Proper building restriction codes can:

(1) Prevent flotation of buildings from their foundations by specifying adequate anchorage.

(2) Establish basement elevations and minimum first floor elevations consistent with potential flood occurrences.

(3) Prohibit basements in those areas subject to very shallow, frequent flooding where filling and slab construction would prevent virtually all damage.

(4) Require building reinforcement to withstand water pressure or high velocity flow and restrict the use of materials which deteriorate rapidly in the presence of water.

(5) Prohibit equipment that might be hazardous to life when submerged. This includes chemical storage, boilers, and electrical equipment.

Development Policies -- Sound policy and action decisions to prevent construction of streets and utility systems in flood-prone areas tend to slow development of the flood plains.

Land Use Restrictions -- Conservation, scenic or flood control restrictions or easements may be acquired for floodway or flood hazard areas where little or no development is desirable. Land use restrictions can be used to prevent development incompatible with public objectives while allowing continued private ownership of the land. Certain future land use rights such as construction of buildings that are not consistent with good flood plain management could be purchased from existing land owners. Permitted existing uses could be farming, wildlife, recreation, parks and woodland. Land use restrictions may also result in a lowering of the land owners' tax assessment.

Greenbelts -- A term related to the development and retention of stream frontages and flood plains is "greenbelt" or "open space." Permissive use of these public or private lands for pasture or grazing, picnic areas, golf courses and similar uses would materially reduce or regulate the damage potential in a high-hazard flood plain area.

Flood Insurance -- This program was established under the Housing and Urban Development Act of 1968 to make limited amounts of flood insurance, which was previously unavailable from private insurers, available to property owners by means of a Federal subsidy. In return for this subsidy, the Act requires that state and local governments adopt and enforce land use and control measures that will restrict future development in flood-prone areas in order to avoid or reduce future flood damage. Flood insurance is available through local insurance agents only after a town applies and is declared eligible by the Flood Insurance Administration, U.S. Department of Housing and Urban Development.

Tax Adjustments -- Lowering the tax rate on land dedicated to agriculture, recreation, conservation or other open-space uses may be effective in preserving existing flood plains or floodways along streams.

Warning Signs -- A method which may be used to discourage development is the erection of flood warning signs in the flood plain area or the prominent posting of previous high water levels. These signs carry no enforcement, but simply serve to inform prospective buyers that a flood hazard exists.

Corrective Measures

Corrective measures are usually physical measures that are designed to reduce or control floods and flood damage and are best used in combination with regulatory measures. Some corrective measures, as described below, are usually necessary where existing developments occupy the flood plains.

Land Treatment -- Both vegetative and mechanical land treatment measures can be installed on the uplands to prevent destruction of land by erosion and reduce the movement of damaging amounts of sediment to the streams and flood plains. Agricultural lands and lands in transition from agriculture to urban uses should be protected or maintained by temporary vegetation, mulch and/or sediment basins to reduce and control erosion. Land treatment measures also slow or reduce runoff and peak flood flows from upland areas.

Floodwater Retarding Structures -- These structures are earthfill or concrete impoundments that check the uncontrolled flow of floodwater rushing downstream. These structures are located and planned to protect the largest possible area of land subject to flooding, encroach as little as possible on high value lands, and provide a high level of protection to downstream property.

Stream Improvements -- Improvement of the stream channel to increase its capacity to carry floodwater can be made by straightening, deepening, widening, clearing, or by lining the channel so that flooding will be less frequent and severe.

Levees -- A levee is an embankment or floodwall along the bank of a stream built to confine flood flows to the channel or floodway. Levees are normally used to provide protection to high risk flood-prone areas.

Reservoir Management Program -- Flood control storage may be obtained by regulating existing recreation or other beneficial use reservoirs or lakes. Temporary storage for floodwater is usually made available in the winter and spring months through the lowering of the pool level. Storage capacity can also be made available when there is a threat of a serious flood, providing there are no restrictions or conflicts in rapidly lowering the pool level.

A plan of operation sets the drawdown limits, time, and rates so that downstream flood problems are not created and upstream water rights are considered. The object of reservoir regulation is to temporarily hold back floodwater that

could contribute to downstream flood peaks, then release it at controlled rates as the flood danger passes.

Flood Proofing of Buildings -- Techniques used to make existing buildings, contents and grounds located in flood hazard areas less vulnerable to flood damage are:

(1) Permanent measures built as an integral part of the structure, such as: raising the elevation of the structure, waterproofing of basement and foundation walls, anchorage and reinforcement of floors and walls, and use of water-resistant materials.

(2) Contingency measures which require action to be taken to make them effective such as manually closed sewer valves and removable bulkheads.

(3) Emergency measures carried out during floods according to prior emergency plans such as sand bagging, pumping, and removal of contents to higher elevations.

Flood Plain Reclamation -- This includes the permanent evacuation of developed areas subject to inundation and the acquisition of lands by purchase, the removal of structures, and the relocation of the population from such areas. Such lands could then be returned to a natural wildlife habitat or used for agriculture, public parks, or other purposes which would not interfere with flood flows.

Flood Watch and Warning Systems -- The National Weather Service of the National Oceanic and Atmospheric Administration issues frequent warnings of potential flood producing storms. Frequently the flood warnings are preceded by a "severe weather or flood watch."

Local programs can also be implemented to give advance warning to flood-prone areas of potential or impending flood danger. On small watersheds with considerable swamp storage staff gages set at key locations could be monitored by local personnel. Monitoring could be accomplished by the use of float-activated electronic warning signals connected to the police or fire department. All warning systems should be coordinated with local Civil Defense disaster plans.

RECOMMENDATIONS

In the course of this study the immediate need for certain flood plain management measures was recognized. These measures can be implemented primarily by the communities within the study area. Prompt action on these recommendations will help alleviate potential flood hazards as well as reduce future flood damages.

East Branch -- Coltsville, south of Dalton Avenue; September 1938 flood.

East Branch -- Coltsville, south of Dalton Avenue; 1973.

Alternatives to Urban Encroachment

The New England River Basins Commission (NERBC) has begun a program to strengthen regional flood plain management systems by evaluating existing flood plain management efforts, accelerating the flood plain delineation activities of federal agencies and promoting state and local flood plain management laws. While regional flood plain management plans are probably the ultimate goal, all long range flood plain management plans (including local) should consider that urban encroachment is inevitable; unless, proper and timely action is taken to control or prevent it. While regional plans may take years to formulate and implement, some aspects of the plan must be recognized and initiated now. This is especially true of urbanization, and communities do have the potential to act now and decide the future use of flood plain lands. The Massachusetts Department of Natural Resources has summarized the legal techniques which communities can employ to protect their flood plain land against urban encroachment. These techniques are listed in Table 11.

An example of urban encroachment is illustrated by the accompanying photographs of the East Branch flood plain in Coltsville. The photographs were taken 35 years apart from the same location. The flood hazard still exists today, but of a greater magnitude due to a more restrictive floodway. The increase in flood damage potential is very apparent in the comparison photographs.

Natural Floodwater Storage Areas

There have been a number of natural floodwater storage areas previously identified within the flood-prone areas. While a few of these areas are extensions of bodies of water, such as Pontoosuc, Onota, and Richmond Pond, others are natural wetland areas, such as Hinsdale Swamp, the Brattle Brook area, and the Unkamet Brook area.

Natural storage areas are extremely valuable for retarding flood flows. Their effectiveness depends upon size and location relative to damageable property. The wetlands within the flood plain, depending upon local land values, usually provide the least expensive method of retarding floodwaters. For this reason these areas should be retained to provide this temporary retardation of floodwaters and to reduce downstream peak discharges.

In addition to the benefits of flood storage these areas offer valuable opportunities ranging from recreational to educational. Summaries of some of the environmental resources of four of the most valuable natural floodwater storage areas follow.

Hinsdale Swamp -- A measure of flood protection for Hinsdale Center is provided by Hinsdale Swamp in its present condition. The East Branch slowly meanders through this swamp for a distance of over two miles. The depth of water appears to be adequate for canoeing.

The vegetative cover in the flat bottomland area adjacent to the stream consists of speckled alder, arrowwood, willow, and silky dogwood. Bordering this shrub vegetation is a narrow belt of woody vegetation comprised of tamarack, black spruce, and white pine. Adjacent to this narrow belt the vegetation changes to a mixed hardwood-softwood forest with hardwoods predominating. Species in this type are quaking aspen, bigtooth aspen, red maple, black cherry, and white pine. The bottomland and adjacent upland cover provide good habitat for a wide variety of wildlife including ruffed grouse, woodcock, whitetail deer, and cottontail rabbit.

Brattle Brook Flood Plain -- The large amount of flood storage available in the Brattle Brook reach on the East Branch effectively diminishes the increased flood peaks normally expected from an intensively urbanized area.

The flood plain in the vicinity of the confluence of Brattle Brook and the East Branch offers as diversified a habitat for wildlife as could be expected considering its proximity to urban lands. The flood plain adjacent to the confluence is an excellent interspersion of open land, brushy thickets, and woodland. Ideally, much of the open land should be maintained as hayland or pastureland to provide the maximum edge between the three major types of vegetative cover. Some of the shrub species observed were speckled alder, silky dogwood, gray stem dogwood, arrowwood, and wild spirea. The most common tree species are red maple and American elm. Wildlife known to inhabit this area includes songbirds such as gold finches, warblers, catbirds, grackles, starlings, robins, bobolinks, red-wing blackbirds, tree swallows, and barn swallows; game birds such as woodcock, ruffed grouse, and pheasant; and other wildlife such as cottontail rabbit, woodchucks, gray squirrels, deer, muskrats, and beaver. The only fish species noted in Brattle Brook was the blacknose dace; however, brown trout have been caught in beaver impoundments in the past. The East Branch through this reach offers a good opportunity for canoeing.

The natural storage areas south of the Brattle Brook confluence are mainly hummocky woodland consisting of red maple, gray birch, American elm, and yellow birch. Understory plants are predominately high bush blueberry and various species of fern. Around the margin of the red maple-elm woodland are dense stands of quaking aspen. (Aspen buds are a prime food source for the ruffed grouse.) A power line right-of-way averaging 100 feet in width traverses this storage area. Along this line there are several pockets of cattail and shrubs including arrowwood, elderberry, silky dogwood, golden rod, and various grasses. This has resulted in a woodland-open land "edge" which is of high value to many species of wildlife.

FLOOD HAZARD ANALYSES
UPPER HOUSATONIC RIVER
MASSACHUSETTS

ALTERNATIVES TO URBAN ENCROACHMENT

TABLE 11
URBAN
ALTERNATIVES

TECHNIQUE	DESCRIPTION
Land Acquisition with Federal or State Financial Assistance:	
Land and Water Conservation Fund Act of 1965 (P.L.89-578, 78Stat.897)	Administered by the U.S. Department of Interior's Bureau of Outdoor Recreation, the fund allocates money to communities and political subdivisions for planning, acquisition and development of public outdoor recreation areas. Under the Act, local agencies may be reimbursed up to 50 percent of the costs of purchasing land.
Massachusetts Self-Help Program (G.L. Ch.132A, Sec.2)	Administered by the Division of Conservation Services in the state's Department of Natural Resources, this program offers towns and cities with conservation commissions up to 50 percent reimbursement for the cost of land purchased or developed for conservation or passive outdoor recreation. BOR's Land and Water Conservation Fund and DNR's Self-Help Program may be applied together. In that case a community may receive up to 75 percent reimbursement for the cost of purchasing land.
National Register of Historic Places (National Historic Preservation Act of 1966, 80Stat. 915,16 U.S.C. 470)	Under this program the National Park Service can make funds available for the acquisition and development of significant historical, archeological, architectural and cultural sites.
Revenue Sharing (P.L. 92-572, Acts of 1972)	Open-space lands can be purchased with community funds received through the federal government's revenue sharing program.
Other Methods of Land Acquisition:	
Gifts of Land	A community, or the state, may acquire land through private donation. Such properties as inland wetlands, nature preserves, wildlife sanctuaries and recreational lands are often donated by private owners to the public.
Gifts of Land in Trust	A well-recognized device in Massachusetts for preserving land in its natural state is a charitable gift in trust. Land gifted to a private land trust is insured against being diverted for other municipal purposes.
Eminent Domain	This is usually a means of last resort. Taking land under eminent domain requires a two-thirds vote of the town meeting or city council. There must be reasonable compensation to the landowner accompanying the taking.
Wetlands Regulation	
Wetlands Protection Act (G.L. Ch.131, Sec.40)	This Act controls, but does not ban development on wetlands. Wetlands are defined here, for the purpose of brevity, as inland wetlands--marshes, meadows, swamps bordering on rivers, streams and ponds--just about any land which is periodically wet. The Act also covers coastal wetlands. The law requires that any person or governmental agency intending to remove, fill, dredge or alter a wetland must insure, by following various procedural and technical steps, that the activity will have no adverse effect on water supplies, storm and flood prevention, pollution prevention or fisheries protection. In effect, the owner must develop his wetlands in accord with the public's interest and safety.
Inland Wetlands Restriction Act (G.L. Ch.131, Sec.40A)	This legislation is designed to supplement the regulative approach of the Wetlands Protection Act with a planning approach not dependent upon the landowner coming forward to apply for a permit. The Commissioner of DNR--in order to preserve / promote public safety, private property, wildlife, fisheries, water resources and flood plain areas and agriculture--is directed to issue orders restricting development of inland wetlands.
Scenic Rivers Act (G.L. Ch.21, Sec.17B)	This Act empowers DNR to restrict or prohibit dredging, filling or otherwise altering or polluting scenic and recreational rivers, which have been defined to include all rivers and streams in the Commonwealth plus contiguous land up to 100 yards on each side of river or stream banks.

TECHNIQUE	DESCRIPTION
Conservation Restrictions:	
Conservation Restriction Act (Ch.666, Acts of 1969)	A conservation restriction or easement is a written agreement between a property owner and a governmental or private agency by which the owner agrees to restrict development of his land in certain ways. For example, a restriction can take the form of prohibiting construction on the land of a building detrimental to preservation of a historical site. Conservation restrictions vary widely. They may be purchased or granted through a gift. They can range from outright purchase of development rights--under which arrangement the local government has the authority to develop the land in an appropriate manner although the land is still privately owned--to simple easements for public rights-of-way. Flood plains, scenic meadows, apple orchards, private fishing ponds, etc., are lands ideally suited for restriction. The owner of land subject to an easement has all the rights and benefits of ownership consistent with the terms of the easement. The easement does not transfer title to the land nor dispossesses its owner, it is, however, binding on all future grantees of the land. A conservation restriction often qualifies a property owner to receive certain tax advantages (G.L. Ch. 719, Acts of 1972) while still permitting use of the land for such purposes as recreation, farming and other activities consistent with the terms of the restriction. For a community, or the state, a restriction is financially beneficial also: when purchasing land for conservation, passive recreation or scenic enjoyment, property can often be acquired at less than full-title purchase, and sometimes at no cost at all if the land is donated by the owner.
Tax Incentives	
Classification and Taxation of Forest Lands and Forest Products (G.L. Ch.61, Secs. 1-7, as amended in 1969 by Ch.873	This law allows forest land to be valued at no more than $10 per acre if the owner of 10 or more acres (valued at not over $400 per acre at the time of application) practices forest management to improve the quantity and quality of a continuing forest crop.
Farmland Assessment Act (G.L. Ch.61A, effective July 1, 1974)	This act allows land (five or more contiguous acres) used for agriculture or horticulture, to be assessed based on actual rather than potential use. The act not only helps the small farmer by reducing the tax burden, but also serves to encourage the preservation of open space.
Local Zoning:	
Flood Plain Zoning (Zoning Enabling Act, G.L. Ch.40A, Sec.2)	In Massachusetts the Zoning Enabling Act specifically permits municipalities to safeguard lands "deemed subject to seasonal or periodic flooding." The Act further states that these lands "shall not be used as to endanger the health or safety of the occupants thereof." Flood Plain Zoning, although designed primarily to prevent damage from floods, can permit use of low-intensity recreation areas while restricting urban development. Conservancy Zoning, a device adopted in several Massachusetts towns, is essentially a variation of flood plain zoning.
Cluster Zoning	The basic idea behind cluster zoning is to create a more attractive environment by permitting a developer to erect houses on smaller lots than the ordinance normally requires, provided that the remaining land is permanently preserved for its natural beauty and recreational value as neighborhood open space.
Historic District	This is a local response to the problem of preserving areas of historic importance while allowing them to remain in private ownership, and protecting these areas from the natural attrition which would occur as modern development, even of high quality, intruded. Historic district zoning imposes; by vote of the town, rigorous controls over an area to prevent visible changes from destroying the historical quality of the environment. In Massachusetts historic districts have been created on Nantucket Island, Beacon Hill in Boston, and in Concord, Lexington, Salem, Falmouth, among others.

USDA-SCS-HYATTSVILLE, MD. 1974

Richmond Pond Wetlands -- The wetlands southwest of Richmond Pond are a natural extension of the pond storage area. Considerable flood protection is provided the Southwest Branch in Pittsfield by temporarily detaining water in the wetlands from the tributaries that originate out of the steep hills of the Taconic Range. Approximately 150 acres were delineated at the 100-year flood elevations within these wetlands. Of this acreage, about 125 acres lies southwest of the railroad. This area was identified in the "Town of Richmond Inventory of Natural Resource Sites" report (Prepared by the Natural Resource Technical Team of Berkshire County in 1967) as site 7. An old stage road bisects the wetland into nearly equal areas at the 100-year flood elevations.

The area north of the old stage road is approximately 60 acres of which 10 acres adjacent to the stream is in open or semi-open vegetative cover (Type 3 wildlife wetland). The channel is about 50 feet wide and meanders through the wetland, affording opportunities for fishing and canoeing. Approximately 300 feet back from the channel, the vegetation changes to woody shrubs consisting of arrowwood, silky dogwood, low species of willow, highbush cranberry and buckthorn. At the perimeter of the wetland, the vegetation is primarily red maple, quaking aspen, black cherry and American elm. Overall, the habitat for songbirds, woodcock, wading birds and muskrat is good.

The approximate 65 acres of Type 4 wildlife wetland lying south of the old stage road crossing provides good habitat for waterfowl, wading birds, many songbird species and aquatic furbearers. Approximately 30 acres is dominated by cattail growth, with water depth less than 2 feet. Surrounding the wetland, the dominant vegetation is red maple and white pine. Vegetation along the railroad bed includes staghorn sumac, gray birch, arrowwood, pin cherry and red maple. A wetland of this size would probably require management by a public wildlife agency to realize its full potential as a wildlife habitat.

Southeasterly view of Richmond Pond Wetlands.

Unkamet Brook Flood Plain -- The environmental resources of the Unkamet Brook wetlands have greatly diminished with the accelerated urban development in the Coltsville area of Pittsfield. Major encroachments in this natural floodwater storage area have occurred. Industrial encroachment along the downstream reach, commercial encroachment in the middle, and residential encroachment and gravel operations in the headwaters have all contributed fill, sediment, debris, and pollutants.

Unkamet Brook has a serious flooding problem, and the problem is two-fold. First, the brook is in a small drainage basin relative to the East Branch and has a lower gradient which results in the basin being lower in elevation. For example, the stream channel bottom of Unkamet Brook at the Dalton Avenue crossing is one foot lower than the stream channel bottom at a point on the East Branch due east of Unkamet Brook. During flood flows on the East Branch it is possible that water backs up Unkamet Brook preventing the brook from entering the East Branch. The second aspect is that stream crossings are all culverts which act as constrictions to flood flows. The stream channel gradient has changed due to siltation, and the structural bottom of the culvert openings do not create a continuous gradient. Several of the culverts easily collect debris which reduces the flow capacity and increases flood stages. These culverts should be checked frequently and the debris removed.

At present there does not appear to be an obvious solution to the Unkamet Brook backwater problem. However, the natural floodwater storage remaining on Unkamet Brook should be preserved, if possible. The natural wetland above Crane Avenue still offers as diversified a habitat for wildlife as could be expected considering its proximity to urban lands. Loss of this natural storage area will increase the Unkamet Brook flood problem as well as that on the East Branch of the Housatonic River. It appears that an in depth study of Unkamet Brook is necessary to arrive at a long-range solution to the flooding problem. It is possible that local protection measures are warranted.

Modification of Existing Development

High Embankment Stream Crossings -- Stream crossings requiring high embankments for grade considerations and which have small openings (culverts) and no flood flow by-pass can create serious flooding problems. During flood flows the embankment and culvert act as a retarding structure when full culvert flow is attained. As flood flows reach the top of the culvert opening, flood stages increase rapidly with only a slight increase in the discharge capacity of the culvert. Consequently, the higher the embankment, the deeper the flood waters that may be impounded. This is beneficial in the respect that floodwater is retarded and peak discharges are reduced downstream, but in some cases flood damages resulting from the backwater offset these benefits. This is apparently the case on the Southwest Branch in the vicinity of the shopping plaza upstream of the high railroad embankment.

In the case of the railroad crossings of Smith, Jacoby, and Shaker Brooks (tributaries to the Southwest Branch) the effect is beneficial because development upstream of the crossings is minimal and downstream peak discharges are reduced. However, the potential for impounding floodwater behind these crossings is not particularly evident to the town official, home builder, or prospective developer. These streams are capable of flash floods flowing directly out of the steep hills of the Taconic Range.

In general the Smith, Jacoby, and Shaker Brooks stream crossings pose a hazard to residents and property upstream and downstream during periods of severe flooding. The upstream effect would be from high flood stages while the downstream effect would be from a possible failure of the embankment and the sudden release of impounded water.

It is therefore recommended that the local units of government involve themselves in a study of possible measures to alleviate or correct the present danger due to flooding imposed by these high embankment stream crossings. Immediate attention should be given the Southwest Branch crossing because of the present potential that exists for upstream flood damage. Other crossing areas with less development should be protected now from urban encroachment.

Reservoir Management Program -- The possible effects of a reservoir management program within the study area were discussed previously in the Potential Floods section for a specific assumed condition. The study did show that such a program probably would have a significant reduction effect on peak flood discharges, especially if the program was an integral part of an overall flood protection plan.

Some areas such as Wahconah Falls Brook above Dalton lack existing reservoirs that could feasibly be regulated for temporary flood storage at this time. Such contributing areas would have to be protected by other measures.

The flood routing of the 100-year storm with the reservoir management program indicated significant flood stage reductions downstream as far as New Lenox Road in Lenox. This would suggest that regulation of reservoirs within the study area could have a significant beneficial effect on communities downstream of the study area.

The potential to reduce peak discharges and stages and consequent flood damages by a reservoir management program appears to exist to the extent to warrant further consideration and study as part of the long-range solution to flooding problems in the watershed.

"Flood Proofing" of Buoyant Objects -- Flood proofing as previously discussed was relative to buildings and their respective grounds. The term "flood proofing" is also applied to any corrective structural measure that could reduce potential flood damages. In this context, flood proofing of objects

subject to floatation by floodwater could reduce structural damages to bridges, buildings, etc., suffered during impact of floating objects. This is especially true of wood products, both raw and processed, and small containers of liquids such as oil.

High chain link fences that have been installed around some properties and highways in the flood plain will function as debris collectors and restrict flood flows. In large floods these fences may let go when hit by floating objects and pass the collected mass of floating debris downstream.

Definite provisions need to be made to ensure that buoyant objects stored on the flood plain will be contained during flood flows in order to reduce certain flood damages and the threat to public safety.

Conduits at Stream Crossings -- A number of stream crossings within the study area have been utilized as supports for conduits crossing the channel. In some cases, the conduits have been located in a manner that would not further restrict the flow of water through the bridge. However, most of the attached or suspended conduits have been located below the top of the bridge opening. Not only does the presence of the conduit reduce the effective bridge area and consequently the flow capacity, but also serves to collect trash and debris which in turn further reduces the flow capacity. Where possible, especially at restrictive stream crossings, the conduits should be located above the top of the bridge opening or beneath the stream channel bottom.

Where possible, utilities in conduits requiring placement on or above ground should not traverse a flood plain. These conduits often require protection in the form of an enveloping embankment which would function as a dike thus restricting flood flows and increasing flood stages. Several such sewer crossings have been constructed in the Housatonic River flood plain with syphons under the river bed.

South Street Crossing over the Housatonic River, with utility conduit.

Removal of Antiquated Dams -- There are numerous dams with small impoundments on the branches of the Housatonic River within the study area. Some of these dams are serving the needs of industry, while others are obsolete. At a time when a particular dam no longer serves a meaningful purpose, removal of the structure could be beneficial by reducing flood stages and damages in that locale. Generally, these dams do not significantly retard or store flood waters, consequently no adverse effect on discharges or water velocities should be expected. Several dams on the Housatonic River and a few on the upper branches have been removed or breached when deemed of no further use or in need of extensive repairs. This is usually in the best interest of flood plain management. Consideration should be given to the removal of sediment behind any structure, before removal of the structure itself.

The benefit derived from the removal of such dams should be weighed against the recreational, wildlife and aesthetic values of the impoundment.

Bel Air Dam on the West Branch

Pond Reclamation -- It has been mentioned previously that the most common form of encroachment is the filling and subsequent development of flood plain lands. However, upland erosion and subsequent downstream sedimentation can be as detrimental to flood stages and peak discharges, as designed fill. If the sedimentation occurs in a pond used for swimming, boating, fishing, etc., the detrimental effect is compounded. Such is the case of Center Pond in the Town of Dalton.

Center Pond is extensively filled with sediment which is reported to have accelerated rapidly in the last two years. Sand bars and mud flats are appearing on the south side of the pond and the channel is being confined to the north side. The flow capacity of the approach channel to Center Pond and the storage capacity of Center Pond have been reduced by the sedimentation. The most serious consequence probably is the reduced flow capacity of the Main Street bridge near the dam. As the sediment is deposited and accumulates from the dam upstream through the bridge the effective area and flow capacity of the bridge will be reduced. This in turn will raise flood stages at the crossing and effect the flood stage of Center Pond.

The surface of the pond has a large quantity of filamentous algae, and the pond's odor suggests the presence of blue-green algae which has additionally affected the recreational use of the pond.

Local residents have expressed a desire to reclaim the pond and return it to its condition of at least 10 years ago. In view of the adverse effects of this sedimentation as stated above, reclamation of Center Pond deserves serious consideration.

Programs Available

Water Watch Program -- Most flood stage information is obtained after a major flood by federal or state agencies concerned with water resource programs. As a result only limited historical flood information has been recorded on the majority of the streams in Massachusetts.

The U.S. Geological Survey maintains a continuous water stage recorder at Coltsville on the East Branch of the Housatonic River and several partial record stations on smaller tributaries. No additional long-term public records of water stages were located during this study except for a number of high water marks (HWMs) obtained from various sources. Many of the HWMs were conflicting presumably because of differences in timing, location, and recording procedures.

The Massachusetts Division of Water Resources, Water Resources Commission has recognized this deficiency of basic data as a deterrent to effective implementation of state wetland laws and community flood plain zoning. In cooperation with the Soil Conservation Service and the Conservation Districts, a statewide "Water Watch" program has been initiated. This program is designed to obtain water elevations of streams, ponds, and swamps at regular intervals and especially during storm periods. The cooperative effort in implementing the program is as follows: staff gages are furnished by the state; technical assistance in locating the measurement sites is provided

by the Soil Conservation Service; and the installation, maintenance, and observations are the responsibility of the local community. The local conservation commission usually conducts the program.

"Water Watch" provides a system to obtain water level data at strategic locations. All readings (by volunteer observers) are sent to the Massachusetts Division of Water Resources which maintains a public record. The compiling of data will show seasonal fluctuations as well as extreme high and low water levels. The primary goal of the program is having the system established and manned by experienced observers when the next flood occurs.

A Water Watch program in the communities that comprise the Upper Housatonic River Study area would be especially beneficial to local conservation commissions, planning boards, and potential developers. Data collected will provide a better basis for planning and administering local and state land use regulations and laws. The Water Watch program could also provide the data and means to implement a local flood warning system, thereby enabling the possible timely evacuation of inhabitants and the installation of temporary flood proofing measures.

Further information on the procedures, eligibility, and priorities for Water Watch programs in Berkshire County can be obtained from the Berkshire Conservation District through the Soil Conservation Service at 20 Elm Street in Pittsfield or from the Massachusetts Division of Water Resources in Boston.

<u>National Flood Insurance Program</u> -- Owners of existing properties within flood-prone areas can now obtain flood insurance at subsidized rates to help them to recover from flood losses, providing their community takes appropriate action to qualify for flood insurance coverage under the National Flood Insurance Program established in 1968. Flood insurance may be purchased at federally subsidized rates for existing structures and contents, up to the maximum limits specified by law, within designated flood zones after the community has been approved to participate in the program. Communities are required to adopt and enforce land use and control measures restricting use of flood-prone areas. These regulations help to allocate flood plain lands to their most appropriate uses and to prevent new developments which would further burden other property owners and the public with the cost of flood losses. Flood insurance is not subsidized on structures built after the program is authorized.

The Flood Disaster Protection Act of 1973, expanded the National Flood Insurance Program by: substantially increasing limits of coverage and the total amount of insurance authorized to be outstanding, and requiring known flood-prone communities to participate in the program. Non participation in the program will preclude federal financial assistance or assistance from lending institutions insured or regulated by a federal agency for development or improvement within the flood-prone areas.

The National Flood Insurance Program is a cooperative effort of the federal government and the private insurance industry and is administered by the Federal Insurance Administration of the U.S. Department of Housing and Urban Development (HUD). Flood insurance policies are obtained through local insurance agents after a community becomes eligible.

Communities may obtain information and assistance regarding qualification for flood insurance directly from the Federal Insurance Administration or the Massachusetts Division of Water Resources. Assistance is also available from the Berkshire County Regional Planning Commission.

The City of Pittsfield is eligible for flood insurance. It is recommended that the other communities in the Upper Housatonic River Study Area take the appropriate action required to qualify for flood insurance under the National Flood Insurance Program as soon as possible. Property owners and tenants will then have the option to purchase federally subsidized flood insurance. The program could provide immediate direction and guidance for a coordinated flood plain management program to avoid or reduce future flood damages. The program can be initiated in any city or town, including those with little or no existing flood damage potential.

Structural Measures -- With the extent of present development in the flood-prone areas within the study area, it appears that even with the most effective regulatory flood plain management programs some residual flood damage may occur. Corrective measures require extensive planning studies to determine benefit-cost relationships and the environmental consequences of alternative measures.

A number of public agencies have water resource programs that consider structural measures, and in some cases provide cost sharing for their installation. State and federal agencies that could assist in the construction of works of improvement include: the Division of Waterways, Massachusetts Department of Public Works, under Chapter 91, of the Massachusetts General Laws; the Soil Conservation Service, USDA, under PL-566, the Watershed Protection and Flood Prevention Act; and the Corps of Engineers, U.S. Army, under the national flood control acts.

The Soil Conservation Service, in cooperation with the Massachusetts Water Resources Commission, is presently engaged in the Massachusetts Water Resources Study which is providing information on water and related land resources of the Commonwealth. One completed phase of this study includes the inventory of potential and existing upstream reservoir sites in the Housatonic River Basin. The second phase, the Comprehensive Report for the Berkshire Region (which includes the Housatonic River Basin) is in preparation. A third phase, a Watershed Investigation Report will assess the feasibility of a PL-566 watershed in the Upper Housatonic River study area.

The Massachusetts Water Resources Commission or the other agencies previously mentioned can provide information and guidance on the available programs related to flood control and environmental resource planning.

INVESTIGATIONS AND ANALYSES

Hydraulic and Hydrologic Studies

Governmental agencies, town officials, and conservation groups were contacted by Soil Conservation Service (SCS) personnel during various phases of the study. The SCS field office in Pittsfield assisted in obtaining survey and other information used in the preparation of this report, and served as liaison with the towns involved. The Massachusetts Department of Public Works provided highway bridge plans, highway profiles, contour maps, and vertical control data. Stream gage and flood records were made available by the U.S. Geological Survey. Hydrologic aspects of the study were coordinated with representatives from the Massachusetts Division of Water Resources. Personal interviews with local residents and copies of newspaper articles and flood photos were helpful in reproducing the historical floods studied.

High water mark information was obtained for the 1936, 1938, and 1948-1949 floods from the Corps of Engineers, the City of Pittsfield Department of Public Works, the Massachusetts Department of Public Works, and the U.S. Geological Survey.

Data related to the natural resource aspects of the flood-prone and storage areas was gathered by an SCS biologist.

Approximately 70 stream channel and valley cross sections, 45 bridge and culvert sections, and 50 road and railroad profiles were surveyed within the study area in 1971-1972. Nearly all of the field surveys were referenced to mean sea level datum. Where available topographic maps with five-foot contour intervals were provided by the Massachusetts Department of Public Works. The most recent U.S. Geological Survey 7½ minute quadrangle sheets with ten-foot contour intervals were used as the overall base map for the study area. Aerial photographs taken in 1970 and 1971 were used to update developments on the base map within the Flood Hazard Areas.

All field surveyed sections were plotted and assigned parameters for the SCS (WSP2) water surface profile computer program. Water surface profiles were run on the computer and a stage versus discharge rating curve was developed for each section. Outflow rating curves were calculated for the major river dams and the following reservoirs: Ashmere, Onota, Pontoosuc, Plunkett, Windsor, Richmond and Cleveland Brook.

A Massachusetts Water Resources River Basin report, being prepared by the Soil Conservation Service for the Massachusetts Water Resource Commission, divided the Housatonic study area into 15 subareas . These subareas were designated numerically from one, and prefixed by HO. The Upper Housatonic River study area is comprised of HO-1, HO-2, HO-3, HO-4, and part of HO-5 (See Plate 1).

For the purpose of flood routing the above five subareas were subdivided into 67 subwatersheds. Subwatershed boundaries were delineated and the drainage areas measured from U.S. Geological Survey 7½ minute quadrangle sheets. Soils data prepared by SCS soil scientists on county soils maps were gridded and summarized for each subarea by hydrologic soil groups. Town land use data were obtained from the Cooperative Extension Service, University of Massachusetts, and updated by conservation needs data to develop present land use for each subarea. The soil and land use data were used to compute composite runoff curve numbers for each subwatershed. Time of concentration and travel times were developed for each subwatershed based on estimated water velocities for overland flow and stream hydraulics.

Storage capacity curves for flood routing purposes were developed for Ashmere, Onota and Pontoosuc Lakes; Plunkett, Windsor, and Cleveland Brook Reservoirs; and Richmond and Center Ponds.

The New Year storm of 1948-1949 was then flood routed through the study area by use of the SCS TR-20 computer program. The rainfall volumes and distributions used in flood routing the historical storm were developed using rainfall records from the two closest recording rain gage stations (Pittsfield WB Airport and Washington). For hydraulic purposes the analysis considered the flood plain as it existed during this historical storm. Developments known to have been installed or altered since the occurrence of this storm were not considered to be in place if they had significant effects upon the present flood stages.

The results of the historical flood routing showed a good correlation between actual high water marks and the computed flood elevations. This verified the watershed input parameters used for the computer programs. The watershed model was then used to analyze synthetic storms of various frequencies. Synthetic storms, with recurrence intervals of 2, 10, 100, and 500 years, were flood routed using the TR-20 program. A storm duration of 24 hours was selected based on the configuration of the study area and travel time studies. The rainfall volumes were based on the U.S. Weather Bureau Publications TP-40 and TP-49.

A frequency analysis was made to compare measured flood flows with the peak flows computed in the Upper Housatonic study area. The U.S. Geological Survey discharge records for the stream gaging station at Coltsville (drainage area of 57.1 square miles and 36 years of record) were used. The computed peaks from the routed discharge-frequency data compared favorably with the analyzed gaged data.

This study of gaged data and the checks against historical flood high water marks reinforced the authenticity of the selection of the synthetic storms used to define the present flooding conditions.

After the watershed model had been verified and the potential storms analyzed, additional studies were conducted with the model to determine the effects

that urbanization, channel improvement, encroachment, and a reservoir management program could have on the study area. The results of these studies are contained in the section on Potential Floods.

In studying the effects of urbanization the changes in runoff curve numbers that would occur as the direct result of a ten percent increase in urban land use were computed. An increased runoff volume was obtained by using the revised weighted runoff curve numbers with the evaluation storm rainfall. By relating present condition runoff volume against the routed flood discharges it was possible to estimate the increased discharges that would result from the increased urbanization in the study area.

Reservoir management was studied as an economical means of possibly reducing the peak discharges and flood stages resulting from the occurrence of the synthetic storms and potential floods previously described.

It was assumed that reservoirs presently used for water supply would be excluded from regulation because their optimum stage for water supply use would be at full storage capacity. The storage capacity curve and outflow rating curves for five selected reservoirs were adjusted to reflect a drawdown stage of 3 to 5 feet below the normal pool elevation. The synthetic storms were again flood routed using the watershed model. Since the only change made over present conditions was the added flood storage capacity of the five reservoirs, the resulting reductions in peak discharges and flood stages throughout the study area could be attributed solely to the assumed reservoir management program.

The potential 100-year flood was used to study the effects of future channelization in several selected areas of Pittsfield. After assuming a design channel for the selected reaches the 100-year storm was flood routed through the watershed and peak discharges, timing of the peaks, and flood stages were compared to those under present conditions.

The effects of flood plain encroachment by the reduction of the floodway width was obtained using the HUD-15 computer program developed by SCS. The program determines the floodway depth-width relationship of stream and valley cross sections. The development of this program was financed by the Federal Insurance Administration. The analysis was based on the assumption that the conveyance of the reduced section was equal to the conveyance of the original cross section, and that each section was independent of upstream and downstream conditions.

Preparation of Maps and Profiles

The limits of the 100-year flood were drawn on the base maps (Plates 5 to 10) to indicate the extent of the area inundated. The base maps are reproductions of the latest 7½ minute U.S. Geological Survey quadrangle sheets with some

modifications to update developments. The flood lines drawn on these sheets are based on several types of field information. Surveyed sections of roads, bridges, channels, valleys, and damage areas provided the most accurate information at most locations. Topographic plans with five-foot contour intervals were used for other areas. In areas where field data was not available flood lines were estimated using aerial photographs with stereoscopic coverage. Attempts were made to field check all questionable areas. Because of the inaccessibility of some portions of the flood plain and the difficult field survey conditions, the flood limits (especially in swampy and wooded areas) may vary on the ground from those shown on the map. Flood profiles or tabulated elevations should be used in all cases where there is a discrepency with the flood lines on the Flood Hazard Area maps. Spot elevations for the 100-year flood were included on the Flood Hazard Area maps at convenient intervals to help correlate the maps with the flood profiles. The flood profiles were drawn at a scale of 1"=2000' and the Flood Hazard Area maps were at a scale of 1"=1000' prior to both being reduced approximately half-size for reproduction.

The flood profiles include the 10-year, 100-year, and Rare flood (500-year) profile lines. Also included on the profiles are pertinent bridge and roadway data, elevations of channel bottom and low bank, and elevations of historical flood high water marks. The profile stationing is in terms of hundreds of feet and is based upon high channel flood flow distances measured from the latest 7½ minute U.S. Geological Survey quadrangle sheets. Flood elevations can be estimated at any location to the nearest foot from the profiles on Plates 11, 12, and 13.

By use of the maps and profiles intelligent flood plain management may be effected with the recognition of the probability and hazards of flooding.

NOTE: Plates 4-13 and Table 12 follow. To aid in determining elevations in the interior portion of Flood Profile Plates 11, 12, and 13 an auxiliary scale has been provided on the right edge of the preceding plate.

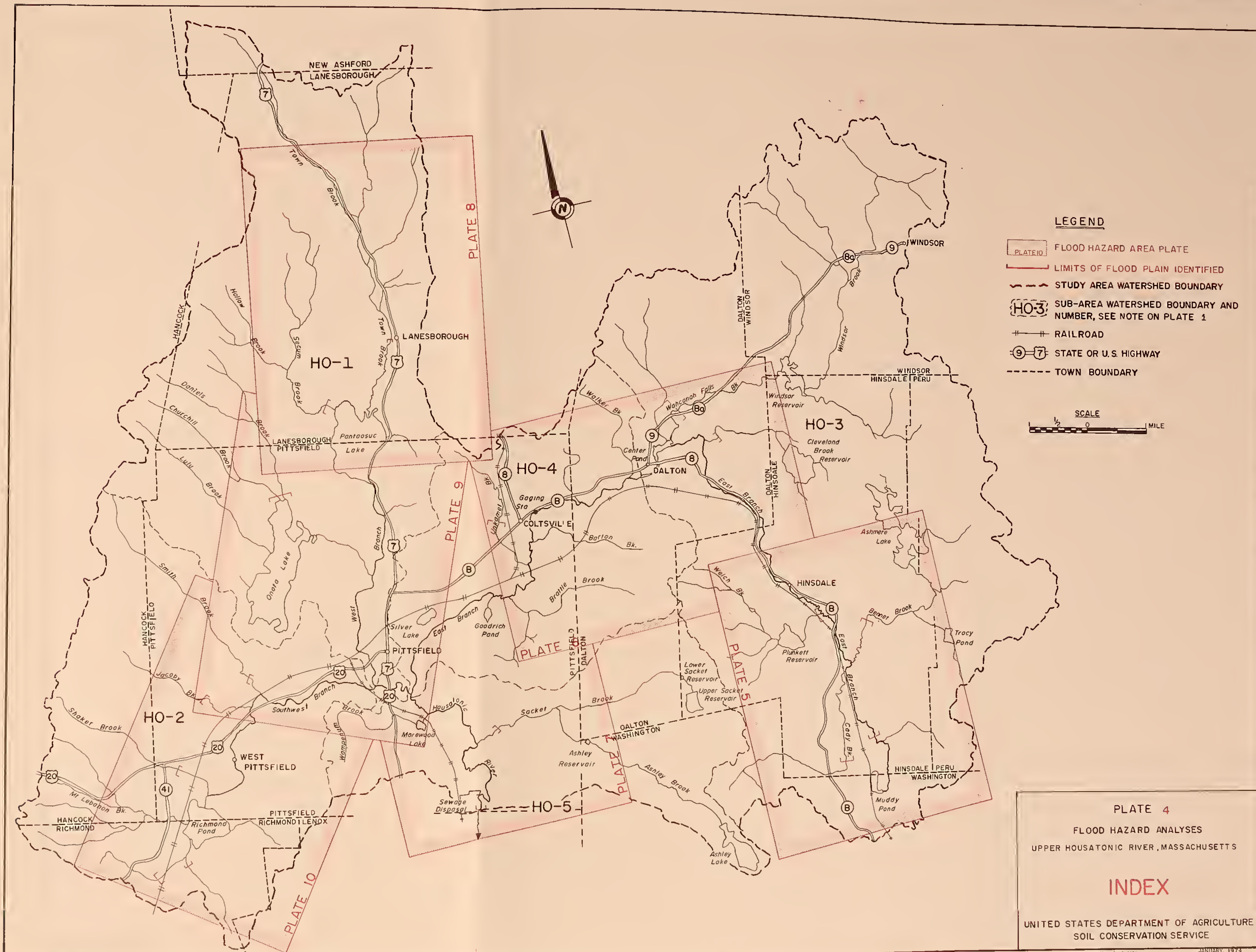


PLATE 4

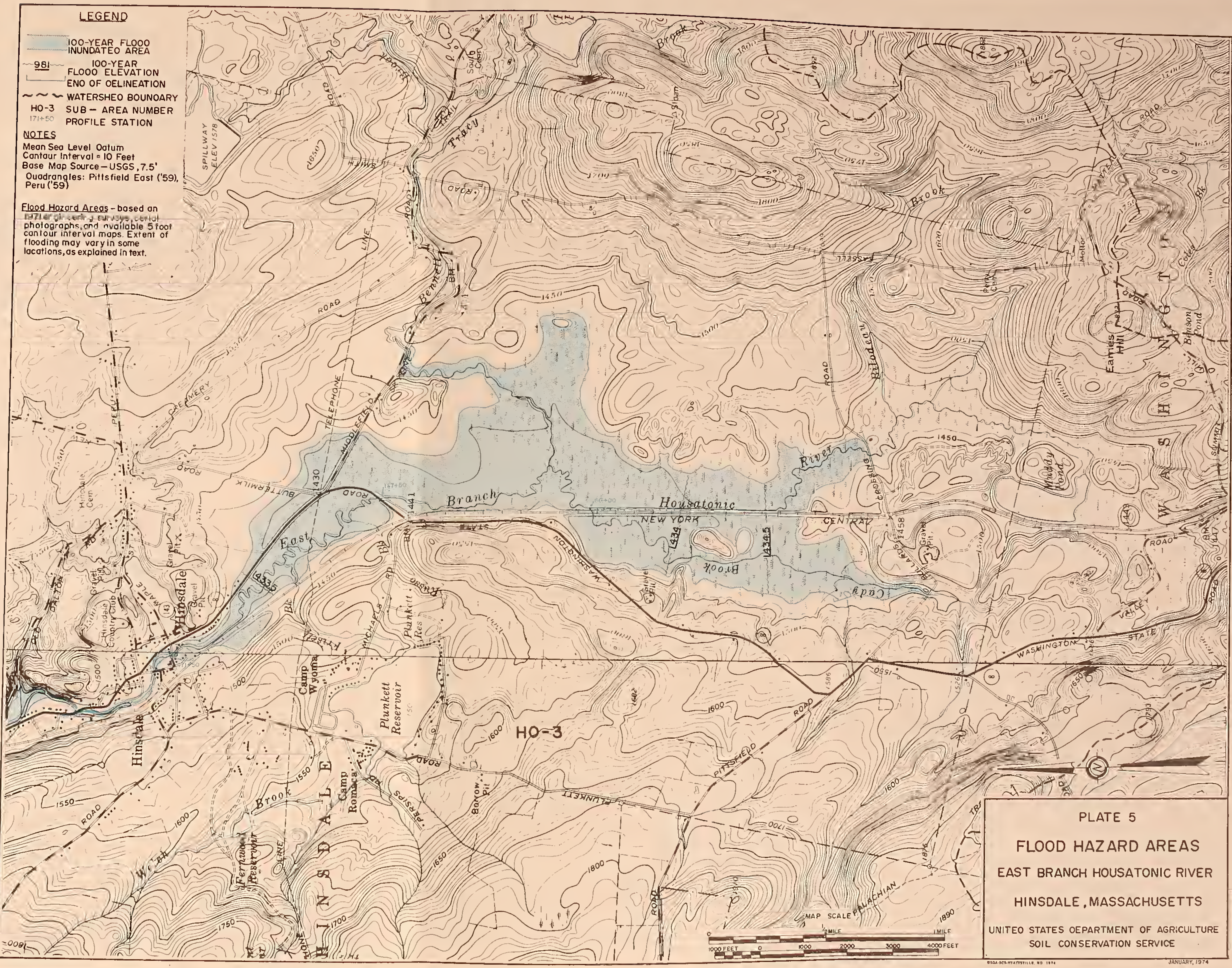
FLOOD HAZARD ANALYSES

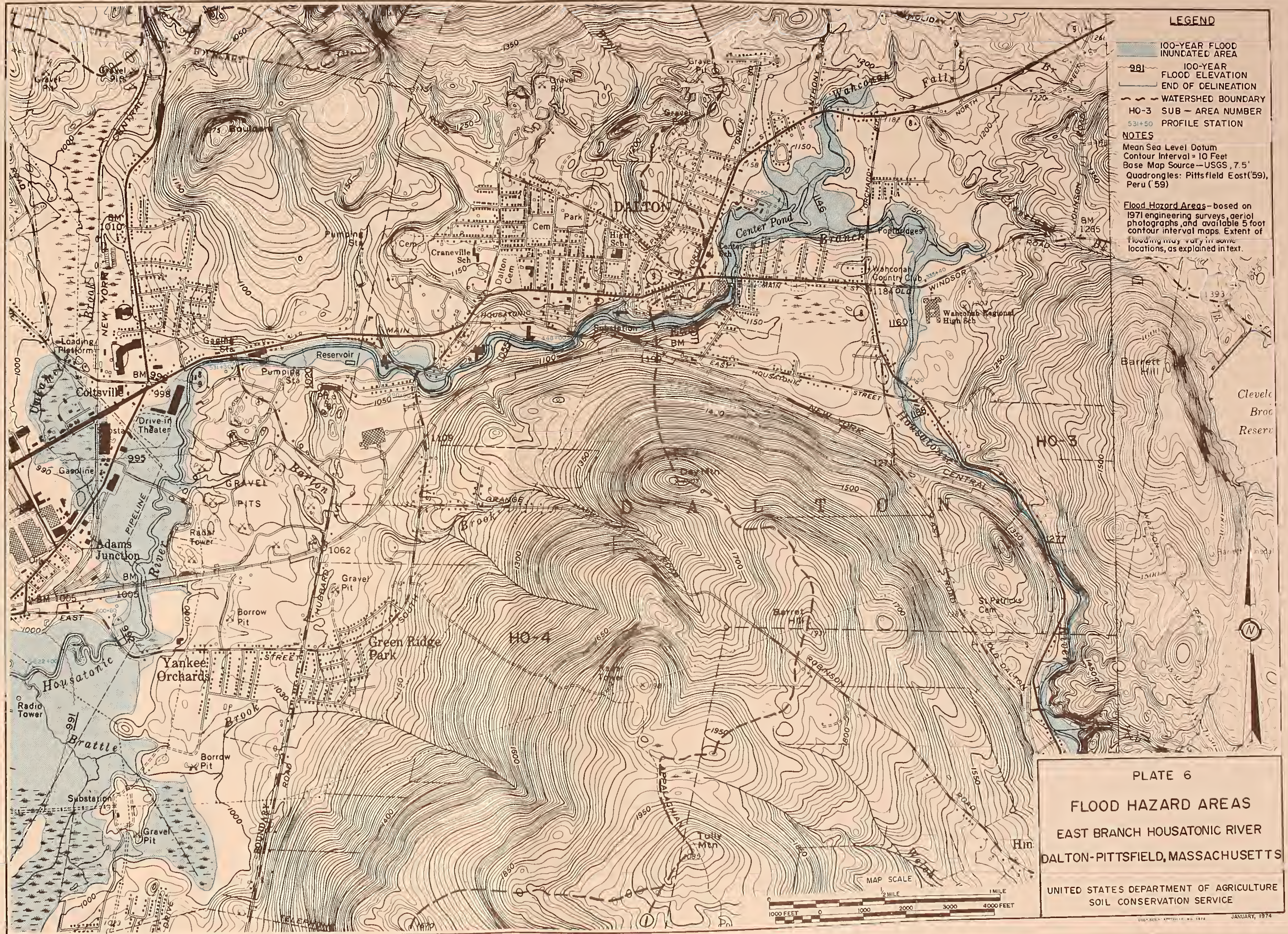
UPPER HOUSATONIC RIVER, MASSACHUSETTS

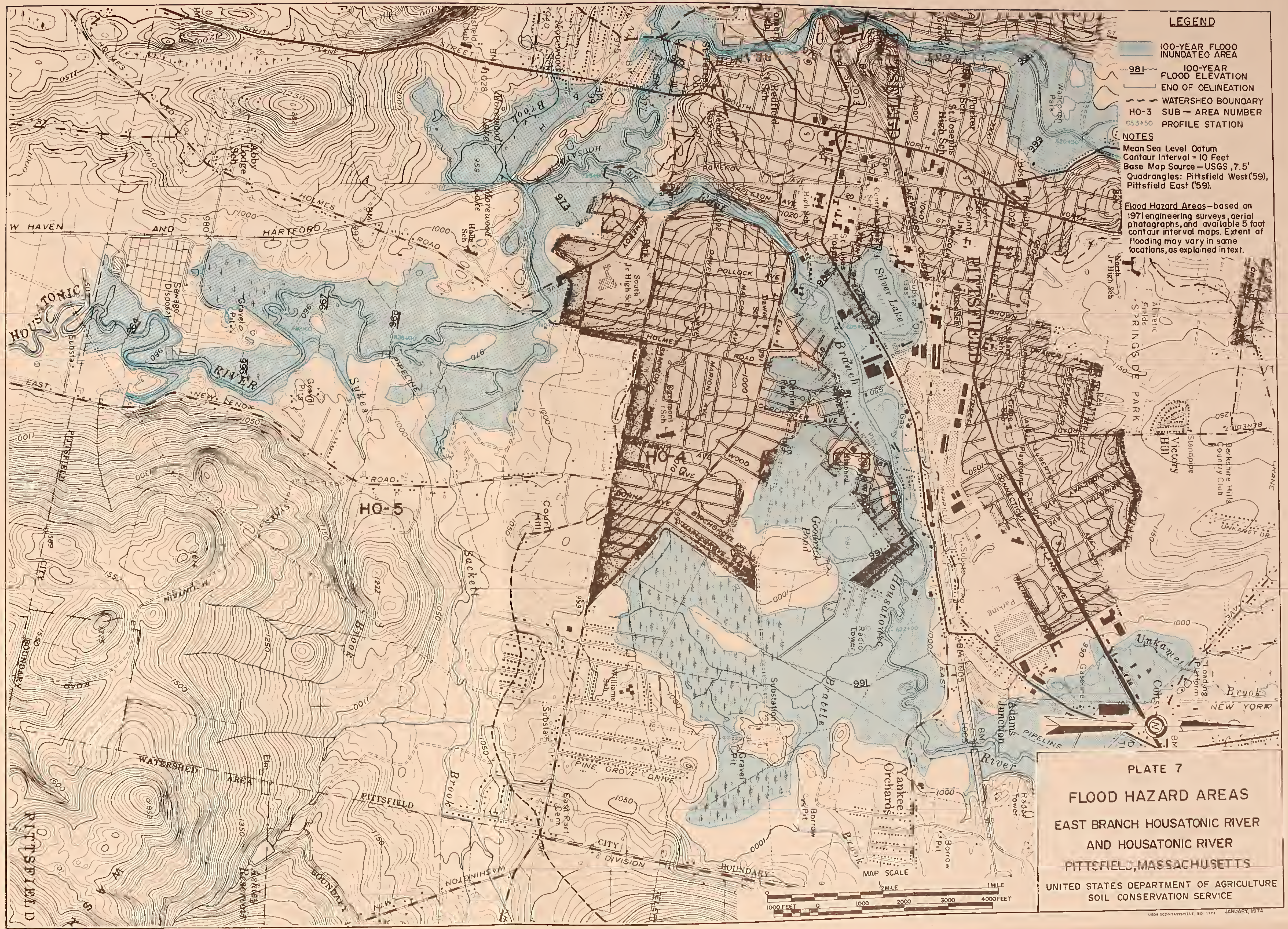
INDEX

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

JANUARY, 1974

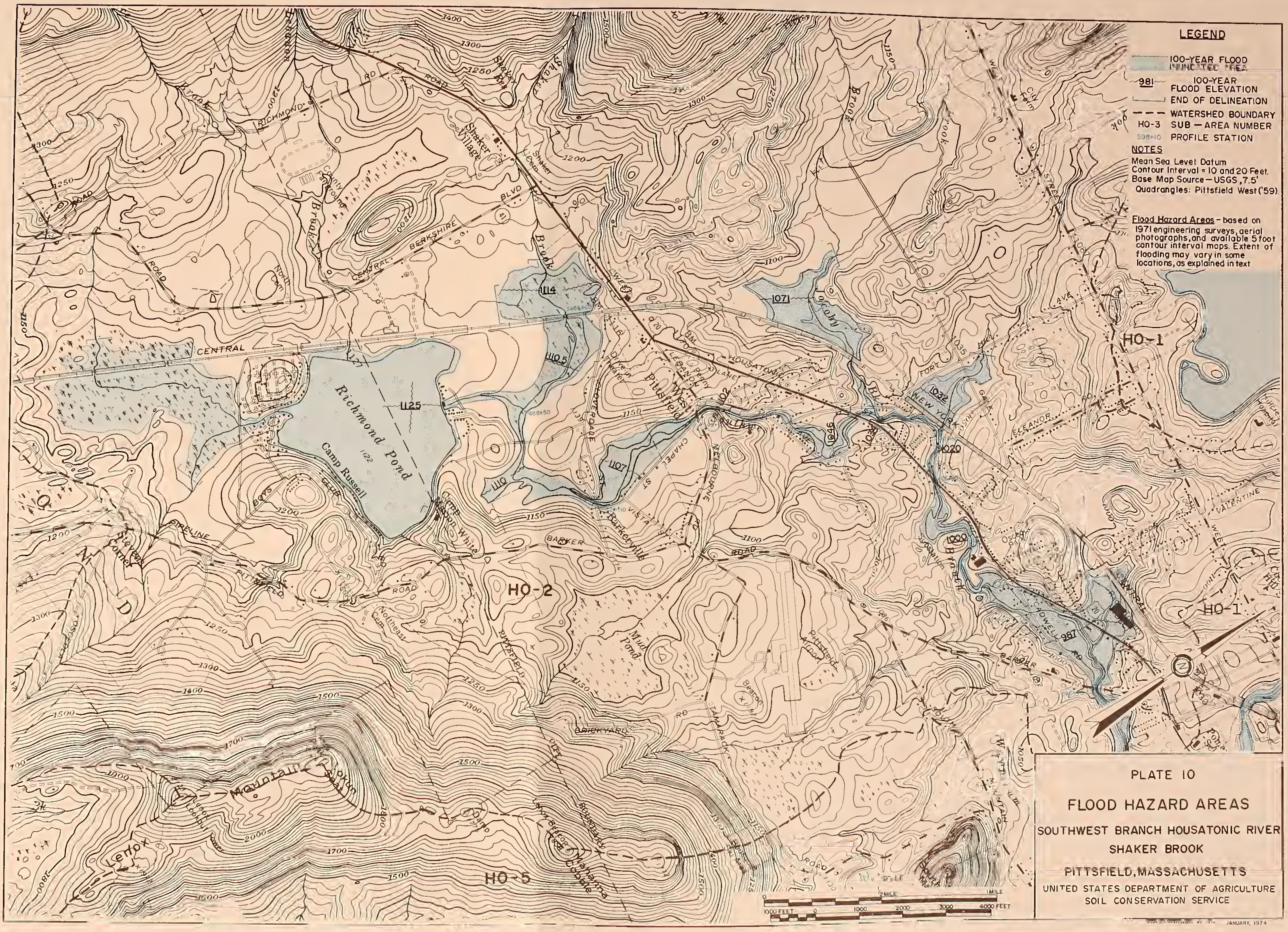

LEGEND
100-YEAR FLOOD INUNDATED AREA
981 100-YEAR FLOOD ELEVATION
END OF DELINEATION
WATERSHED BOUNDARY
HO-3 SUB – AREA NUMBER
171+50 PROFILE STATION
NOTES
Mean Sea Level Datum
Contour Interval = 10 Feet
Base Map Source – USGS, 7.5' Quadrangles: Pittsfield East ('59), Peru ('59)
Flood Hazard Areas - based on
photographs, and available 5 foot contour interval maps. Extent of flooding may vary in some locations, as explained in text.
East Branch Housatonic River
NEW YORK CENTRAL
HO-3
HINSDALE
Hinsdale
Plunkett Reservoir
Camp Wyoma
Camp Romaca
Fernwood Reservoir
Muddy Pond
Earles Hill
Bennett Brook
Cady Brook
Tracy Brook
WASHINGTON STATE ROAD
PITTSFIELD ROAD
MAP SCALE
1/2 MILE 1 MILE
1000 FEET 0 1000 2000 3000 4000 FEET
PLATE 5
FLOOD HAZARD AREAS
EAST BRANCH HOUSATONIC RIVER
HINSDALE, MASSACHUSETTS
UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
JANUARY, 1974


LEGEND
100-YEAR FLOOD INUNDATED AREA
981 100-YEAR FLOOD ELEVATION
END OF DELINEATION
WATERSHED BOUNDARY
HO-3 SUB — AREA NUMBER
531+50 PROFILE STATION
NOTES
Mean Sea Level Datum
Contour Interval = 10 Feet
Base Map Source—USGS, 7.5' Quadrangles: Pittsfield East('59), Peru ('59)
Flood Hazard Areas—based on 1971 engineering surveys, aerial photographs, and available 5 foot contour interval maps. Extent of flooding may vary in some locations, as explained in text.
DALTON
Coltsville
Adams Junction
Yankee Orchards
Green Ridge Park
Center Pond
Wahconah Falls
Wahconah Country Club
Wahconah Regional High Sch
Craneville Sch
Housatonic
Brattle Brook
Barton Brook
Dalton Mtn
Barrett Hill
Tully Mtn
St Patricks Cem
HO-3
HO-4
D A L T O N
MAP SCALE
1/2 MILE
1 MILE
1000 FEET 0 1000 2000 3000 4000 FEET
PLATE 6
FLOOD HAZARD AREAS
EAST BRANCH HOUSATONIC RIVER
DALTON-PITTSFIELD, MASSACHUSETTS
UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
JANUARY, 1974


LEGEND
100-YEAR FLOOD INUNDATED AREA
981 100-YEAR FLOOD ELEVATION
END OF DELINEATION
WATERSHED BOUNDARY
HO-3 SUB — AREA NUMBER
653+50 PROFILE STATION
NOTES
Mean Sea Level Datum
Contour Interval = 10 Feet
Base Map Source — USGS ,7.5' Quadrangles: Pittsfield West('59), Pittsfield East ('59).
Flood Hazard Areas — based on 1971 engineering surveys, aerial photographs, and available 5 foot contour interval maps. Extent of flooding may vary in some locations, as explained in text.
PLATE 7
FLOOD HAZARD AREAS
EAST BRANCH HOUSATONIC RIVER
AND HOUSATONIC RIVER
PITTSFIELD, MASSACHUSETTS
UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
JANUARY, 1974
MAP SCALE
1/2 MILE
1 MILE
1000 FEET
0
1000
2000
3000
4000 FEET
PITTSFIELD
HOUSATONIC
RIVER
HO-4
HO-5
Silver Lake
Goodrich Pond
Unkamet Brook
Sackett Brook
Sykes Brook
Brattle Brook
Yankee Orchards
Springside Park
Victory Hill
Berkshire Hills Country Club
Adams Junction
WATERSHED AREA
PITTSFIELD CITY DIVISION BOUNDARY
PINE GROVE DRIVE
HOLMES ROAD
HARTFORD
NEW LENOX
Ashley Reservoir


LEGEND
100-YEAR FLOOD INUNDATED AREA
981 100-YEAR FLOOD ELEVATION
END OF DELINEATION
WATERSHED BOUNDARY
HO-3 SUB — AREA NUMBER
230+50 PROFILE STATION
NOTES:
Mean Sea Level Datum
Contour Interval = 10 and 20 Feet.
Base Map Source — USGS, 7.5' Quadrangles: Pittsfield West ('59), Pittsfield East ('59), Hancock ('60), Cheshire ('59).
Flood Hazard Areas — based on 1971 engineering surveys, aerial photographs, and available 5 foot contour interval maps. Extent of flooding may vary in some locations, as explained in text.
Location of flood stages shown on Flood Profile Plate 12.
HO-1
HO-4
Pontoosuc Lake
Town Brook
Secum Brook
MAP SCALE
1/2 MILE
1 MILE
1000 FEET
0
1000
2000
3000
4000 FEET
PLATE 8
FLOOD HAZARD AREAS
TOWN BROOK
LANESBOROUGH, MASSACHUSETTS
UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
JANUARY, 1974

LEGEND
100-YEAR FLOOD INUNDATED AREA
981 100-YEAR FLOOD ELEVATION
END OF DELINEATION
WATERSHED BOUNDARY
HO-3 SUB — AREA NUMBER
529+70 PROFILE STATION
NOTES:
Mean Sea Level Datum
Contour Interval = 10 and 20 Feet.
Base Map Source — USGS, 7.5' Quadrangles: Pittsfield West ('59), Pittsfield East ('59), Hancock ('60), Cheshire ('59).
Flood Hazard Areas – based on 1971 engineering surveys, aerial photographs, and available 5 foot contour interval maps. Extent of flooding may vary in some locations, as explained in text.
ONOTA LAKE
Pontoosuc Lake
HO-1
HO-2
HO-4
HO-5
PITTSFIELD
MAP SCALE
1/2 MILE
1 MILE
1000 FEET 0 1000 2000 3000 4000 FEET
PLATE 9
FLOOD HAZARD AREAS
WEST BRANCH HOUSATONIC RIVER
ONOTA BROOK
PITTSFIELD, MASSACHUSETTS
UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
USDA-SCS-HYATTSVILLE, MD. 1974
JANUARY, 1974


LEGEND
100-YEAR FLOOD INUNDATED AREA
981 100-YEAR FLOOD ELEVATION
END OF DELINEATION
WATERSHED BOUNDARY
HO-3 SUB — AREA NUMBER
598+10 PROFILE STATION
NOTES
Mean Sea Level Datum
Contour Interval = 10 and 20 Feet.
Base Map Source — USGS, 7.5' Quadrangles: Pittsfield West ('59).
Flood Hazard Areas - based on 1971 engineering surveys, aerial photographs, and available 5 foot contour interval maps. Extent of flooding may vary in some locations, as explained in text.
Richmond Pond
Camp Russell
Shaker Village
Barkerville
HO-1
HO-2
HO-5
PLATE 10
FLOOD HAZARD AREAS
SOUTHWEST BRANCH HOUSATONIC RIVER
SHAKER BROOK
PITTSFIELD, MASSACHUSETTS
UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
½ MILE
1 MILE
1000 FEET 0 1000 2000 3000 4000 FEET
JANUARY, 1974

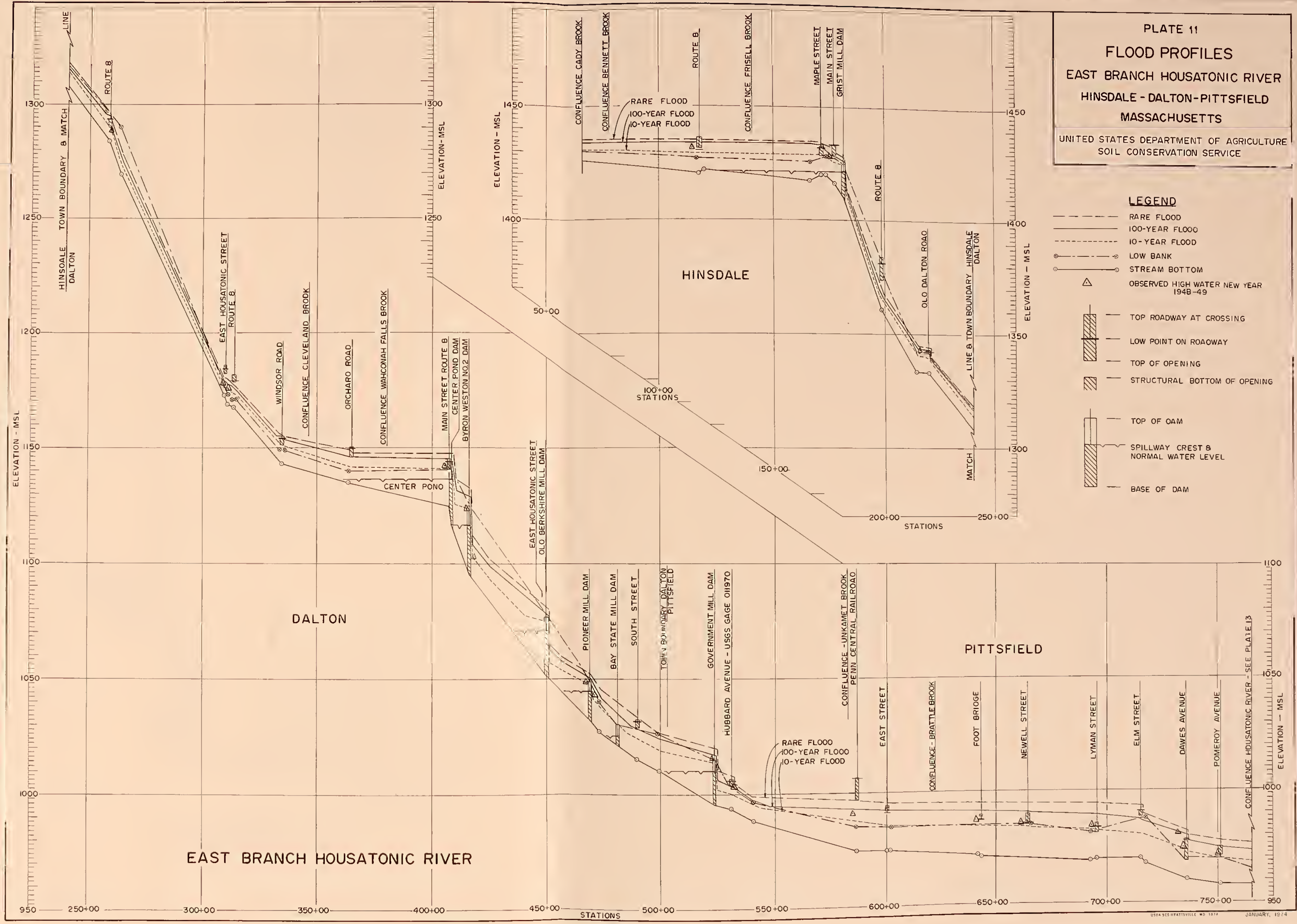


PLATE 11
FLOOD PROFILES
EAST BRANCH HOUSATONIC RIVER
HINSDALE - DALTON - PITTSFIELD
MASSACHUSETTS
UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
LEGEND
RARE FLOOD
100-YEAR FLOOD
10-YEAR FLOOD
LOW BANK
STREAM BOTTOM
OBSERVED HIGH WATER NEW YEAR 1948-49
TOP ROADWAY AT CROSSING
LOW POINT ON ROADWAY
TOP OF OPENING
STRUCTURAL BOTTOM OF OPENING
TOP OF DAM
SPILLWAY CREST & NORMAL WATER LEVEL
BASE OF DAM
HINSDALE
DALTON
PITTSFIELD
EAST BRANCH HOUSATONIC RIVER
ELEVATION - MSL
STATIONS
CONFLUENCE CADY BROOK
CONFLUENCE BENNETT BROOK
ROUTE 8
CONFLUENCE FRISELL BROOK
MAPLE STREET
MAIN STREET
GRIST MILL DAM
OLD DALTON ROAD
LINE & TOWN BOUNDARY HINSDALE DALTON
MATCH
HINSDALE DALTON TOWN BOUNDARY & MATCH LINE
EAST HOUSATONIC STREET
WINDSOR ROAD
CONFLUENCE CLEVELAND BROOK
ORCHARD ROAD
CONFLUENCE WAHCONAH FALLS BROOK
MAIN STREET ROUTE 8
CENTER POND DAM
BYRON WESTON NO.2 DAM
CENTER POND
OLD BERKSHIRE MILL DAM
PIONEER MILL DAM
BAY STATE MILL DAM
SOUTH STREET
TOWN BOUNDARY DALTON PITTSFIELD
GOVERNMENT MILL DAM
HUBBARD AVENUE - USGS GAGE 011970
CONFLUENCE - UNKAMET BROOK
PENN CENTRAL RAILROAD
EAST STREET
CONFLUENCE - BRATTLE BROOK
FOOT BRIDGE
NEWELL STREET
LYMAN STREET
ELM STREET
DAWES AVENUE
POMEROY AVENUE
CONFLUENCE HOUSATONIC RIVER - SEE PLATE 13
JANUARY, 1974

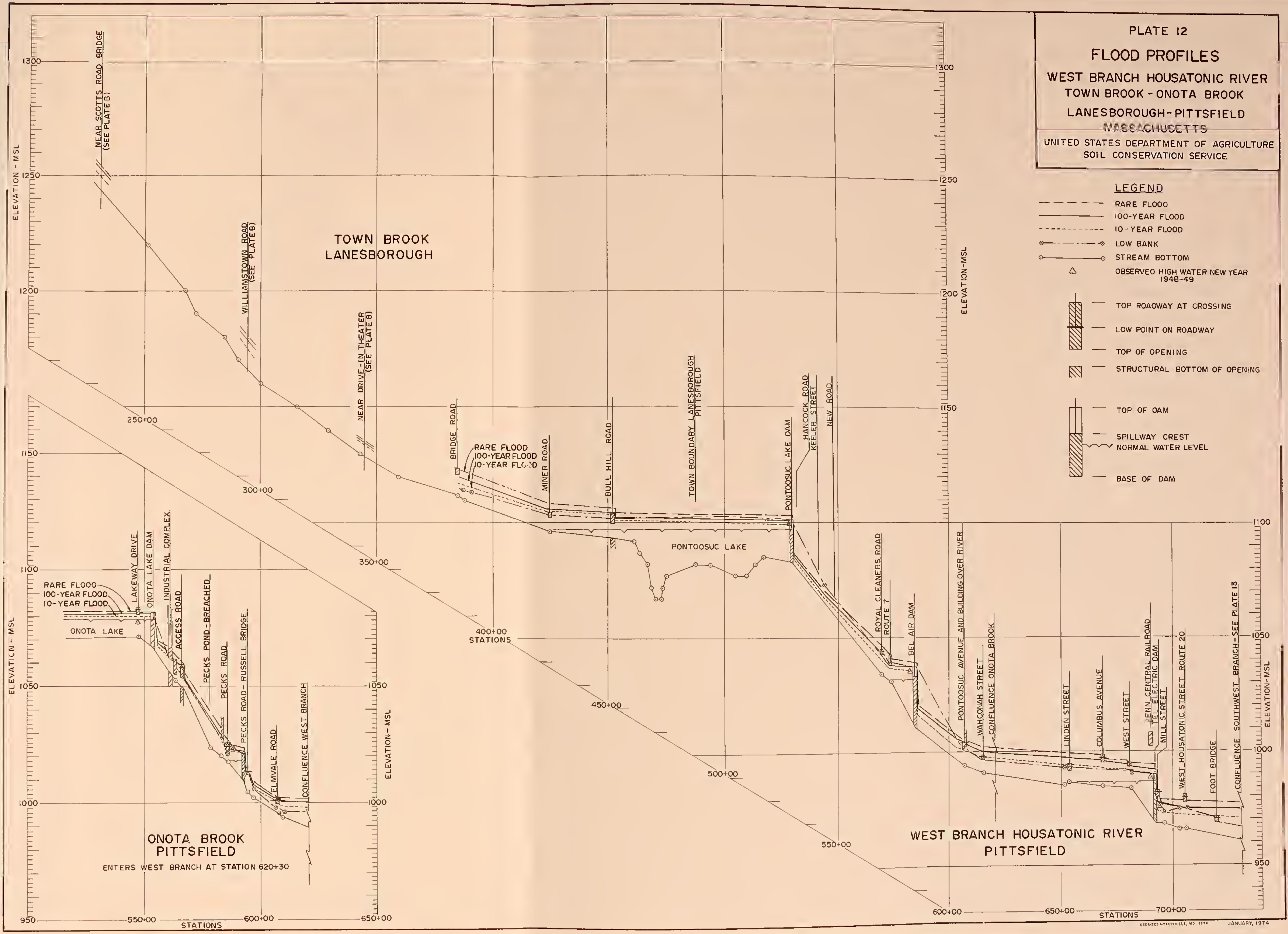


PLATE 12
FLOOD PROFILES
WEST BRANCH HOUSATONIC RIVER
TOWN BROOK - ONOTA BROOK
LANESBOROUGH - PITTSFIELD
MASSACHUSETTS
UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
LEGEND
RARE FLOOD
100-YEAR FLOOD
10-YEAR FLOOD
LOW BANK
STREAM BOTTOM
OBSERVED HIGH WATER NEW YEAR 1948-49
TOP ROADWAY AT CROSSING
LOW POINT ON ROADWAY
TOP OF OPENING
STRUCTURAL BOTTOM OF OPENING
TOP OF DAM
SPILLWAY CREST
NORMAL WATER LEVEL
BASE OF DAM
TOWN BROOK
LANESBOROUGH
NEAR SCOTTS ROAD BRIDGE (SEE PLATE 8)
WILLIAMSTOWN ROAD (SEE PLATE 8)
NEAR DRIVE-IN THEATER (SEE PLATE 8)
BRIDGE ROAD
MINER ROAD
BULL HILL ROAD
TOWN BOUNDARY LANESBOROUGH PITTSFIELD
PONTOOSUC LAKE DAM
HANCOCK ROAD
KEELER STREET
NEW ROAD
PONTOOSUC LAKE
ELEVATION - MSL
STATIONS
ONOTA LAKE
LAKEWAY DRIVE
ONOTA LAKE DAM
INDUSTRIAL COMPLEX
ACCESS ROAD
PECKS POND - BREACHED
PECKS ROAD
PECKS ROAD - RUSSELL BRIDGE
ELMVALE ROAD
CONFLUENCE WEST BRANCH
ONOTA BROOK
PITTSFIELD
ENTERS WEST BRANCH AT STATION 620+30
ROYAL CLEANERS ROAD ROUTE 7
BEL AIR DAM
PONTOOSUC AVENUE AND BUILDING OVER RIVER
WAHCONAH STREET
CONFLUENCE ONOTA BROOK
LINDEN STREET
COLUMBUS AVENUE
WEST STREET
PENN CENTRAL RAILROAD
TEL ELECTRIC DAM
MILL STREET
WEST HOUSATONIC STREET ROUTE 20
FOOT BRIDGE
CONFLUENCE SOUTHWEST BRANCH - SEE PLATE 13
WEST BRANCH HOUSATONIC RIVER
PITTSFIELD
JANUARY, 1974

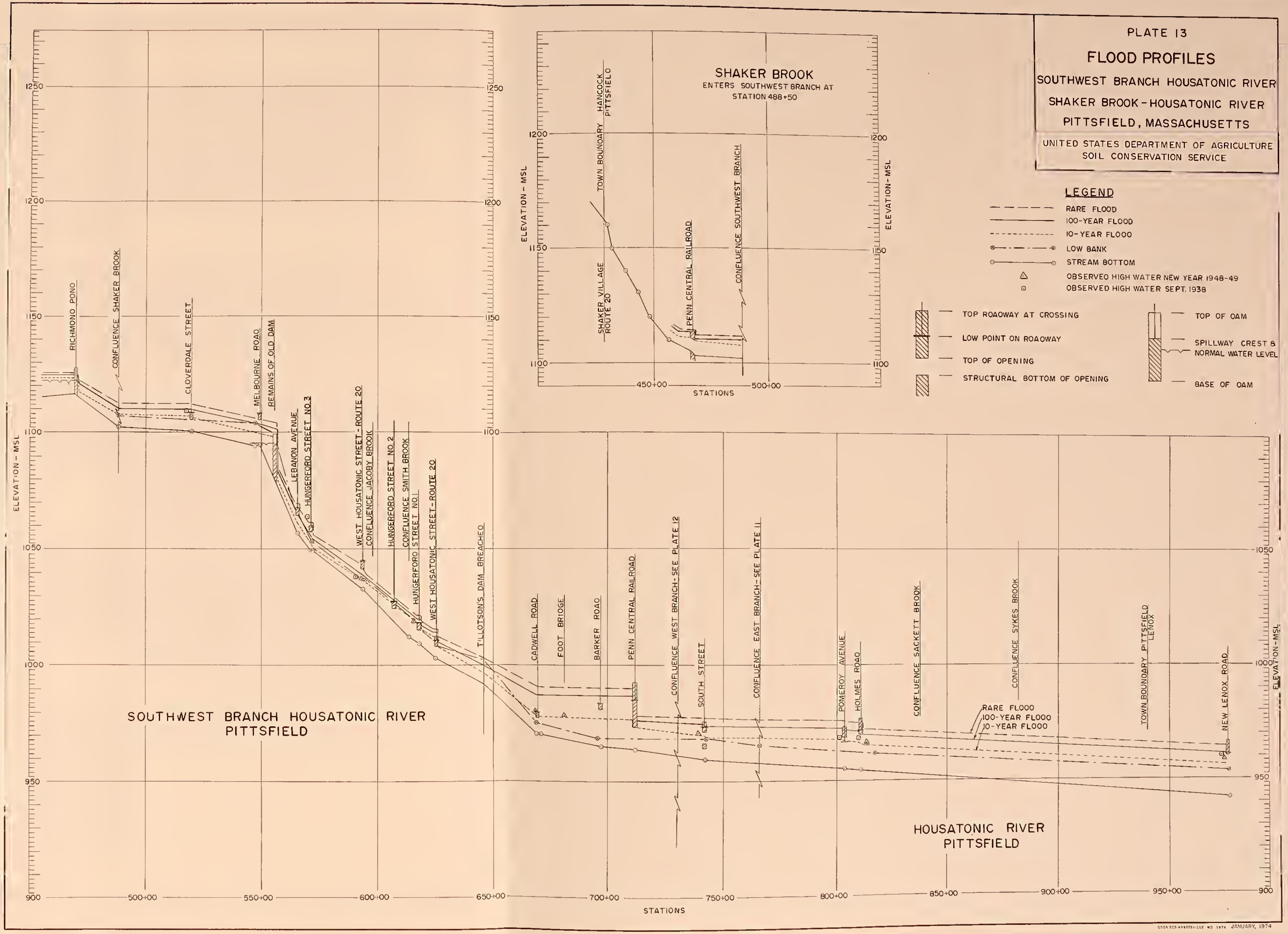


PLATE 13
FLOOD PROFILES
SOUTHWEST BRANCH HOUSATONIC RIVER
SHAKER BROOK - HOUSATONIC RIVER
PITTSFIELD, MASSACHUSETTS
UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
LEGEND
RARE FLOOD
100-YEAR FLOOD
10-YEAR FLOOD
LOW BANK
STREAM BOTTOM
OBSERVED HIGH WATER NEW YEAR 1948-49
OBSERVED HIGH WATER SEPT. 1938
TOP ROADWAY AT CROSSING
LOW POINT ON ROADWAY
TOP OF OPENING
STRUCTURAL BOTTOM OF OPENING
TOP OF DAM
SPILLWAY CREST & NORMAL WATER LEVEL
BASE OF DAM
SHAKER BROOK
ENTERS SOUTHWEST BRANCH AT STATION 488+50
TOWN BOUNDARY HANCOCK PITTSFIELD
SHAKER VILLAGE ROUTE 20
PENN CENTRAL RAILROAD
CONFLUENCE SOUTHWEST BRANCH
ELEVATION - MSL
STATIONS
450+00
500+00
RICHMOND POND
CONFLUENCE SHAKER BROOK
CLOVERDALE STREET
MELBOURNE ROAD
REMAINS OF OLD DAM
LEBANON AVENUE
HUNGERFORD STREET NO.3
WEST HOUSATONIC STREET - ROUTE 20
CONFLUENCE JACOBY BROOK
HUNGERFORD STREET NO.2
CONFLUENCE SMITH BROOK
HUNGERFORD STREET NO.1
WEST HOUSATONIC STREET - ROUTE 20
TILLOTSON'S DAM BREACHED
CADWELL ROAD
FOOT BRIDGE
BARKER ROAD
PENN CENTRAL RAILROAD
CONFLUENCE WEST BRANCH - SEE PLATE 12
SOUTH STREET
CONFLUENCE EAST BRANCH - SEE PLATE 11
POMEROY AVENUE
HOLMES ROAD
CONFLUENCE SACKETT BROOK
CONFLUENCE SYKES BROOK
TOWN BOUNDARY PITTSFIELD LENOX
NEW LENOX ROAD
RARE FLOOD
100-YEAR FLOOD
10-YEAR FLOOD
SOUTHWEST BRANCH HOUSATONIC RIVER
PITTSFIELD
HOUSATONIC RIVER
PITTSFIELD
900
950
1000
1050
1100
1150
1200
1250
500+00
550+00
600+00
650+00
700+00
750+00
800+00
850+00
900+00
950+00
STATIONS
JANUARY, 1974

DESCRIPTION OF SOIL SERIES

SERIES	DESCRIPTION
Fredon	These are poorly drained soils formed in thick deposits of sands and gravel derived largely from limestone, schist, and phyllite. They have a fine sandy loam surface soil and a fine sandy loam or gravelly fine sandy loam subsoil underlain at a depth of about 2 feet by layers of sands and gravel. They have rapid or moderately rapid permeability in the surface soil and subsoil and rapid permeability in the substratum. The water table is at or near the surface for 7 to 9 months of the year. They are generally free of stones and boulders but may contain cobbles. They occupy depressions and low flat areas.
Hadley	These are well drained soils formed in very fine sands and silts recently deposited by streams and rivers. The Hadley soils have a very fine sandy loam or silt loam surface soil and subsoil and are generally underlain by layers of loamy very fine sand or very fine sand. In places they have a loamy very fine sand surface soil and subsoil. Below 40 inches there may be layers of sands and gravel. The permeability is moderate or moderately rapid in the surface soil and subsoil. They occur on level and nearly level areas adjacent to streams and rivers and are subject to flooding.
Limerick	These are poorly drained bottom-land soils formed in silts and very fine sands recently deposited by streams and rivers. The Limerick soils have a silt loam surface soil and a silt loam or very fine sandy loam subsoil. These soils are moderately permeable but are wet for 7 months or more each year due to a high water table. They occur on flat flood plains adjacent to rivers and streams and are subject to flooding.
Made land	This land type consists of areas filled with earth or other kinds of material, or is so altered that the soils cannot be identified. Areas filled with trash can be very unstable for long periods of time as there may be considerable settling of the material as the trash decomposes. Areas filled with earth become stabilized after relatively short periods of settling. On-site investigations are required on these areas before decisions can be made regarding land utilization.
Muck	These are very poorly drained bog soils formed in accumulations of organic deposits that are underlain by mineral soil materials. The upper part of the organic material is generally black and has decomposed to such a degree that plant remains cannot be identified by the unaided eye. Decomposition of the materials in the lower part of the deep Muck soils varies from this condition to one of practically no decomposition in which plant remains are readily identifiable. Muck soils occupy depressions and potholes. The water table is at or near the surface most of the year. Some Muck soils have only 1 to 3 feet of organic deposits over mineral soil materials. In others the organic deposits are many feet thick.
Ninigret	These are moderately well drained soils that have formed in thick sand deposits. They have a fine sandy loam or sandy loam surface soil and subsoil and a loamy sand or sand substratum. They are gravel free and are crumbly to a depth of 3 feet or more. The permeability is moderately rapid or rapid in the surface soil and subsoil and is rapid in the substratum. Ninigret soils have a seasonal high water table that is within 18 to 30 inches of the surface. This condition prevails in winter, spring, and during prolonged periods of rainfall. The Ninigret soils occur on level areas to gentle slopes.
Peat	These are very poorly drained bog soils formed in organic deposits which are underlain by mineral soil material. Peat soils have dark reddish colors and the plant remains can be identified by the unaided eye. These soils are mostly woody peat with some sphagnum peat areas. They occur in depressions and potholes in which the water table is at or near the surface most of the year. Some of the soils have 1 to 3 feet of organic matter over mineral soil material but most of them have many feet of organic material.
Podunk	These are moderately well drained bottom-land soils that have formed in sands recently deposited by streams and rivers. They have a fine sandy loam or sandy loam surface soil and subsoil. In places, the surface consists of thin layers of sand. The Podunk soils are often underlain by sands and gravel at depths greater than 2 feet. They do not have stones or boulders on the surface or within the soil. They occur on level areas adjacent to rivers and streams and are subject to flooding. Some are flooded every year. A fluctuating high water table keeps them wet from late fall to late spring. The soils have moderately rapid or rapid permeability in the surface soil and subsoil and rapid permeability in the substratum.
Rumney	These are poorly drained, bottom-land soils that have formed in sands recently deposited by streams and rivers. Rumney soils have a fine sandy loam or sandy loam surface soil and subsoil. They do not have stones or boulders on or below the surface. In places they contain thin layers of coarse sand, sand, and gravel at a depth of 20 inches or more. They are wet for 7 or more months of the year due to a high water table. They occur on level areas on flood plains adjacent to streams and rivers and are subject to flooding by stream overflow.
Saco	These are very poorly drained, bottom-land soils formed in recent floodwater deposits. The Saco soils have a silt loam surface soil and a silt loam or very fine sandy loam subsoil. They occur in depressions and low flat areas adjacent to streams and rivers. The soils are wet most of the year and are frequently flooded by stream overflow. They do not have stones or boulders on or in the soil.
Scarboro	These are very poorly drained soils that have formed in thick deposits of sands and gravel derived largely from granite and gneiss rocks. The Scarboro soils commonly have a black sandy or mucky surface soil and a sandy subsoil that may be underlain by gravel in places. They occupy depressions and low flat areas and are kept wet most of the year by a high water table. They have rapid permeability. They are usually free of stones and boulders.
Suncook	These are excessively drained, bottom-land soils formed in sandy materials recently deposited by floodwaters of streams and rivers. The soils have a loamy fine sand or sand surface soil and subsoil. They commonly have interbedded layers of sands, loamy sands, coarse sands and gravel. Permeability is rapid throughout the soil. The Suncook soils are generally free of stones and boulders. They are subject to flooding by stream overflow. They occupy level to gently sloping areas adjacent to streams and rivers.
Walpole	These are poorly drained soils developed in thick deposits of sands or sands and gravel. The soils have a fine sandy loam surface soil and a sandy loam subsoil that is underlain by layers of sands or sands and gravel at a depth of about 24 inches. They occur mainly in depressions and low flat areas and have a water table close to the surface that keeps them saturated with water for 7 to 9 months of the year. These soils usually have no stones or boulders but may contain gravel or cobbles. In a few places the soils may have a stony surface, but they only have very few or no stones below the surface soil. Walpole soils have a moderately rapid or rapid permeability in the surface soil and subsoil and rapid permeability in the substratum.
Winooski	These are moderately well drained, bottom-land soils that have formed in very fine sands and silts recently deposited by streams and rivers. The Winooski soils have a very fine sandy loam or silt loam surface soil and subsoil. Sand and gravel layers may occur below depths of 3 feet. Permeability is moderate or moderately rapid. These soils are wet in the spring and sometimes in the late fall and winter due to a fluctuating high water table. Winooski soils occur on nearly level or level areas adjacent to rivers and streams. Those on the low-lying areas are flooded annually, but some of the higher areas are flooded only about once every ten years.

The soil series descriptions were excerpted from the City of Pittsfield soils report entitled "Soils and Their Interpretations for Various Land Uses." This report was prepared by the Soil Conservation Service in March 1969.

USDA-SCS-HYATTSVILLE, MD. 1974

GLOSSARY OF TERMS

Bridge Area -- The effective hydraulic flow area of a bridge opening accounting for the presence of piers, attached conduits, and skew (alignment), if applicable.

Channel -- A natural or artificial water course of perceptible extent with definite bed and banks to confine and conduct continuously or periodically flowing water.

Flood -- An overflow of lands not normally covered by water and that are used or useable by man. Floods have two essential characteristics: the inundation of land is temporary; and the land is adjacent to and inundated by overflow from a river, stream; ocean, lake, or other body of standing water. Normally a "flood" is considered as any temporary rise in stream flow or stage, but not the ponding of surface water that results in significant adverse effects in the vicinity. Adverse effects may include damages from overflow of land areas, temporary backwater effects in sewers and local drainage channels, creation of unsanitary conditions or other unfavorable situations by deposition of materials in stream channels during flood recessions, rise of ground water coincident with increased stream flows, and other problems.

Flood Frequency -- A means of expressing the probability of flood occurrences as determined from a statistical analysis of representative stream flow or rainfall and runoff records. It is customary to estimate the frequency with which specific flood stages or discharges may be equalled or exceeded, rather than the frequency of an exact stage or discharge. Such estimates by strict definition are designated "exceedence frequence," but in practice the term "frequency" is used. The frequency of a particular stage or discharge is usually expressed as occurring once in a specified number of years. Also see definition of "recurrence interval."

10-year Flood - A flood having an average frequency of occurrence in the order of once in 10 years. It has a 10 percent chance of being equalled or exceeded in any given year. It is based on statistical analyses of streamflow records available for the watershed and analyses of rainfall and runoff characteristics in the general region of the watershed.

100-year Flood - A flood having an average frequency of occurrence in the order of once in 100 years. It has a 1% chance of being equalled or exceeded in any given year. It is based on statistical analyses of streamflow records available for the watershed and analyses of rainfall and runoff characteristics in the general region of the watershed. This flood is comparable to the "Intermediate Regional Flood" used by the U.S. Army Corps of Engineers.

Flood Frequency (continued)

Rare Flood - The flood that may be expected from a combination of meteorological and hydrological conditions that are considered extreme but reasonable for that geographical area, excluding extremely unlikely conditions. It may be considerably larger than any flood that has occurred in the watershed. However, an even larger and more severe flood can and probably will occur.

For the purpose of this study, it is considered to have an approximate average frequency of occurrence in the order of once in 500 years, although the flood may occur in any given year. It is based on statistical analyses of streamflow records available for the watershed and analyses of rainfall and runoff characteristics in the general region of the watershed.

Flood Peak -- The highest stage or discharge attained during a flood event; also referred to as peak stage or peak discharge.

Flood Plain (general) -- The relatively flat area or low lands adjoining the channel of a river, stream, or watercourse; ocean, lake, or other body of standing water which has been or may be covered by floodwater.

Flood Plain (specific) -- A definitive area within a flood plain (general) or flood-prone area known to have been inundated by an historical flood, or determined to be inundated by floodwater from a potential flood of a specified frequency.

Flood-Prone Area -- Synonomous with Flood Plain (general).

Flood Profile -- A graph showing the relationship of water surface elevation to stream channel location. It is generally drawn to show the water surface elevation for the peak of a specific flood, but may be prepared for conditions at a given time or stage.

Flood Stage -- The elevation of the overflow above the natural banks of a stream or body of water. Sometimes referred to as the elevation at which overflow begins.

Flood Storage -- The difference in the volume of storage between the initial base flow elevation and the flood peak elevation measured for a specific storage area.

Floodway -- The channel of the stream and that portion of the flood plain that is inundated by a flood and used to carry the flow of the flood.

High Water Mark (HWM) -- The maximum observed and recorded height or elevation that floodwater reaches during a storm, usually associated with the flood peak. The high water mark may be referenced to a particular building, bridge, or other landmark, or based on debris deposits on bridges, fences, or other evidence of the flood.

Low Bank -- The highest elevation at a specific stream channel cross section at which the flow in the stream can be contained in the channel without overflowing into adjacent overbank areas.

Low Point on Roadway -- The lowest elevation on a road profile usually in the vicinity of where the road and stream cross. It is the first point on the roadway inundated if overtopping of the road occurs during a storm.

Potential Flood -- A spontaneous event (natural phenomenon) capable of occurring from a combination of meteorological, hydrological, and physical conditions; the magnitude of which is dependent upon specific combinations. See Flood and Flood Frequency.

Rare Flood -- See Flood Frequency.

Recurrence Interval -- The average interval of time based on a statistical analysis of actual or representative streamflow records which can be expected to elapse between floods equal to or greater than a specified stage or discharge. Recurrence interval is generally expressed in years. Also see definition of Flood Frequency.

Roadway at Crossing (Top) -- The elevation of the roadway at the road and stream crossing immediately above the stream channel. It may be higher than the low point of the roadway.

Runoff -- That part of precipitation, as well as any other flow contributions, which appears in surface streams of either perennial or intermittent form.

Stream Channel -- A natural or artificial water course of perceptible extent, with defintie bed and banks to confine and conduct continuously or periodically flowing water.

Stream Channel Bottom -- The lowest part of the stream channel (either in a constructed cross section or a natural channel). Bottom elevations at a series of points along the length of a stream may be plotted and connected to provide a stream bottom profile.

Stream Channel Flow -- That water which is flowing within the limits of a defined water course.

Structural Bottom of Opening -- The lowest point of a culvert or bridge opening with a constructed bottom through which a stream flows that could tend to limit the stream channel bottom to that specific elevation. This structural bottom may be covered with sediment or debris which further restricts the size of the opening.

Top of Opening -- The lowest point of a bridge, culvert or other structure over a river, stream or watercourse that limits the height of the opening through which water flows. This is referred to as "low steel" or "low chord" in some regions.

Watershed -- A drainage basin or area which collects and transmits runoff usually by means of streams and tributaries to the outlet of the basin.

Watershed Boundary -- The divide separating one drainage basin from another.

Wetland -- Areas where the water table is at or near the surface of the ground and the soil remains wet for more than seven months of each year. Wetlands include swamps, marshes, and wet meadows.

Specific Types

Type 3 -- Inland Shallow Fresh Marshes -- The soil is usually waterlogged during the growing season and often covered with as much as 6 inches or more of water. Typical vegetation includes grasses, spikerushes, cattails and pickerelweed.

Type 4 -- Inland Deep Fresh Marshes -- The soil is covered with 6 inches to 3 feet or more of water during the growing season. Typical vegetation includes cattails, spikerushes, pondweeds, waterweeds, and waterlilies.

Type 5 -- Inland Open Fresh Water -- Shallow ponds and reservoirs are included in this type. Water is usually less than 10 feet deep and is fringed by a border of emergent vegetation. Typical vegetation includes pondweeds, coontail, and waterlilies.

SOIL CONSERVATION SERVICE